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ABSTRACT

This set of eight reports is a product of the Mathemagenic Activities Program (MAP) for early childhood education of the University of Georgia Follow Through (FT) Program. Based on Piagetian theory, the MAP-FT projects are comprehensive education programs for children (K - 3) from low income families that are designed to continually challenge children to learn about the physical and social environments. Five of the reports are products of MAP evaluation efforts in Gulfport, Mississippi: Lee County, Virginia: Pickens County, Georgia: McCormick, South Carolina: and Pocatello, Idaho. One paper provides a perspective for MAP-FT evaluation. Another reports an experiment in compensatory education which is intended to contribute to FT evaluation. The eighth report is a study of the time required for teachers in MAP projects to effectively implement the model's classroom learning environment. Evaluation data indicate, to varying degrees, that the programs were effective in maintaining children's abilities and countering cumulative deficits in some areas of academic achievement. Results of the experiment in compensatory education indicate that the MAP model of FT was effective in non-verbal areas but not in verbal areas. The implementation study found that third and fourth years of program operation yielded higher average achievement scores than the second year. During the third year MAP-FT teachers reached a peak in fostering academic achievement. (RH)

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MATHEMAGENIC ACTIVITIES PROGRAM: EVALUATION REPORTS. (Title Supplied)
Charles D. Smock, Editor

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Follow Through
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MATHEMAGENIC ACTIVITIES PROGRAM
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CHARLES D. SMOCK, DIRECTOR
May, 1976

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THE INFLUENCES OF PROGRAM AND TEACHER MATURITY ON ACADEMIC ACHIEVEMENT

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Preface

The National Follow Through research and development program was designed to discover which of several educational models might be best suited to the tasks of: 1) providing children from low income families with more appropriate early educational opportunities and, 2) broadening the basis of educational decision making. The plan includes identifying ways and means for extending the model's program to the total school system and/or to new communities. To plan for such an extension (or proliferation) information concerning the length of time required to train teachers, resource teachers, etc. is critical. This report is based on a preliminary study of the time required for teachers in the MAP projects to achieve effective implementation of the model's classroom learning environment. In this study, effectiveness of teacher implementation is defined in terms of children's success on standardized achievement tests.

There are several limitations to the investigation that should be mentioned. First, teacher effectiveness needs to include measures of general cognitive and personal-social development as well as academic skill learning. Second, a clear description of the correspondence of the actual classroom learning environment (CLE) to MAP ideal CLE needs to be included. Finally, only a few teachers were available for inclusion in this study. The follow up study will have more extensive data available on which to draw conclusions relevant to the potentiality of the model for more extensive use in other communities.

C. D. Smock, Director

Abstract

Two questions relevant to the proliferation of the Mathemagenic Activities Program-Follow Through (MAP-FT) are (1) Does the number of years that the program has been in a community affect the performance of the children? and (2) Does the number of years that teachers have been in the program affect the performance of children they teach? Several statistical analyses (multivariate analyses of covariance), examining changes in the spring academic performances of MAP-FT first graders in four communities, were undertaken to answer these questions.

Though the available data were limited, tentative conclusions can be made that: For both first-year MAP-FT teachers as well as more experienced teachers, the third and fourth years of program operation yielded higher average achievement scores than the second year. Examination of teacher experience revealed that during the third year in MAP-FT teachers reach a peak in fostering academic achievement.

Introduction

The evaluation of special educational programs and the assessment of their effects on children, teachers, parents, and a community have been, in the past, usually focused on a very short period of time. Furthermore, the interest has often been on comparing the performance or behavior of children against some standard; either against an alternative program, or against a set of previously stated objectives. Such investigations are often quite revealing and yield information useful for deciding upon subsequent courses of action. An investigative evaluative approach that has not appeared much in the literature is that of the study of what may be termed "program maturity". Various meanings of program maturity may be considered. In question form, one meaning might be expressed as, Does the number of years that a program has been in a school (or community) affect the performance of the children? Another meaning might be expressed as, Does the number of years that teachers have been in a program (or grade-level) affect the performance of children they teach? A third meaning might be expressed as, Does the number of years that children have been in a program affect their performance?

As with many proposed research questions, definitive answers to the above three questions are, with limited resources, next to impossible. In contrast to an experimental setting, the inability to impose rigid controls in a natural setting make the task a difficult one. In light of the difficulties, however, a tentative (or partial) answer to the first and second questions was sought in the setting of a particular educational program (viz., a Follow Through program).

THE INFLUENCES OF PROGRAM AND TEACHER MATURITY ON ACADEMIC ACHIEVEMENT[1,2]

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May, 1976

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MAP Follow Through

The Follow Through model considered here is the Mathemagenic Activities Program (MAP), centered at the University of Georiga. A University of Georgia Follow Through program started in fall, 1968. A revised program, that of the MAP, emerged in the fall of 1970, with projects located in five sites (or communities); a sixth project site was added in fall, 1971. In MAP a project within a community is conceived as a "minature comprehensive school system" to provide a model for achieving various general educational objectives. It is assumed that an educational system should be a "mechanism for change." Further, the position is that the educational program must be based on the nature of psychological development of the child and the continuity of the school learning environment with the child's multiple extra-school "learning environments."

The instructional philosophy of MAP is reflected in the following three statements: (1) Cognitive and affective development are products of interactions between the child and his environment. It is not sufficient that the child merely copy his environment; he must be allowed to actively construct his own interpretation in terms of his own level of development. (2) The child's interactive exchanges with the environment must be at both the mental and physical level of activity. (3) The child is attracted and challenged to learn by tasks representing the next step beyond his current experience and knowledge level. Thus, the emphasis in MAP is on learning by doing and individual decision-making on the part of the child. Instructional strategies are designed to create a learning environment with: (a) appropriate discrepancy between the child's current level of functioning and task requirements

(Mismatch); (b) coordinated actions, both physical and symbolic (Activity); and (c) options for the child in terms of difficulty of task, mode of learning, and type of task (Personal regulation).

Maccoby and Zellner (1970, pp. 25-26) classified some 10 Follow Through programs in operation in the late 1960s into three groups. Programs in Group A are oriented toward "self-actualization," with emphasis on children's socio-physical goals. Programs in Group B are oriented toward "behavior modification," with emphasis on reinforcing children for desired behaviors. Programs in Group C are oriented toward "cognitive growth," with emphasis on concept development through experience and exploration. The MAP may be placed in Group C, in which performance on intellectual tasks is thought of as reflecting the level of development of mental structures and operations. In this school of thought, education provides an environment so as to facilitate the normal stage-wise growth of these processes.

Method

Project Sites

The MAP Follow Through sites considered in the present investigation are: Gulfport, Mississippi; Pickens County, Georgia; McCormick County, South Carolina; and Lee County, Virginia. All four sites became involved in Follow Through operations with a grade 1 class in fall, 1969. Two other project sites now implementing the MAP model (Martins Ferry, Ohio, and Pocatello, Idaho) were excluded from this investigation because of the lack of data.

Gulfport is a city of approximately 45,000, about one-sixth of the population in the Gulf Coast Region; the mean family income of this community, which includes 18% non-white, is near $8,000. A total of approximately 1000 children is enrolled in grades one through three, 27% of which are non-white. The counties of Pickens, McCormick, and Lee are basically rural communities. Approximately 10,000 people, of which 3.5% is non-white, reside in the central

North Georgia county of Pickens, with a mean family income of about $7,500. There are approximately 600 children enrolled in grades 1-3. McCormick County, in southwestern South Carolina, has about 8,000 residents, with about 60% non-white; the mean family income is about $6,000. Grades 1-3 have approximately 550 children. The nearly 100% white southwest Virginia County of Lee has about 20,000 residents with a mean family income of nearly $4,000. There are approximately 800 children enrolled in grades 1-3.

Child Measurements

Implicit in the previous description of the MAP philosophy, and explicit in MAP implementation and practice, is an emphasis on the total development of the child. However, for the present study, only longitudinal data reflecting performance and skills in academics were available.[1] The Metropolitan Readiness Tests (MRTs) were administered to all incoming first grade children in all sites at the beginning of each school year. In Lee County, end-of-year academic achievement data were obtained by administering the California Achievement Test (CAT) in the spring. The eight CAT subtests are Reading Vocabulary, Reading Comprehension, Mathematics Computation, Mathematics Concepts and Problems, Language Auding, Language Mechanics, Language Usage and Structure, and Language Spelling. In the other three sites considered in this investigation, the Stanford Achievement Test (SAT) was administered in the spring. The six SAT subtests are Word Reading, Paragraph Meaning, Vocabulary, Spelling, Word Study Skills, and Arithmetic. The criterion measures used, then, were obtained through the use of the CAT (1970 edition) or the SAT (1964 edition), with the concomitant measure being that from the MRTs (1964 edition). Only measures on first grade children in the four sites were considered in this report.

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[1] Recently, social and cognitive competence data have been collected in many of the project sites; subsequent studies will include analyses of these data.

Data Analyses

The number of analyses conducted and their scope were necessarily restricted because of the somewhat limited longitudinal data available. Three analyses were conducted in an attempt to investigate the differential effects of the number of years that MAP was in a given community on the academic performance of first grade children. Each of the three analyses called for a simple multivariate analysis of covariance (MANCOVA) with the independent variable being Year, the criterion measures being subtest scores on achievement tests, and the covariate measure being the total score on the MRTs.

The first two analyses involved teachers and children in Lee County; the criterion measures were the eight CAT subtests scores. The five teachers (two in 1971-72, three in 1972-73) from Lee County considered in Analysis 1 had completed only their first year in MAP; thus, the third versus the fourth years of MAP operation were considered, holding MAP teaching experience at one year.

Analysis 2 was based on a design similar to that of Analysis 1, except that a common set of five teachers from Lee County was involved for the two years, 1971-72 and 1972-73. At the close of 1972-73 these five teachers had completed four years of MAP teaching experience. Thus child performance (as measured by scores on CAT partialling out MRT scores) was measured in a setting in which MAP had been in operation for three versus four years, with experienced MAP teachers.

Analysis 3 involved teachers and children in Gulfport. All of the 13 teachers completed one year in MAP; five by 1970-71, five by 1971-72, and three by 1972-73. Criterion measures were the six subtest scores on the SAT. Here, child performance was compared across three years of MAP operation, again with first-year MAP teachers. In these three analyses, as well as in the three following analyses, the unit of analysis considered was individual child.

Analysis 4 involved four teachers from three project sites over three years (1970-71, 1971-72, 1972-73). The two teachers from Pickens, one from McCormick, and one from Gulfport all had completed four years in MAP as of spring 1973. This analysis called for a two-way (Site by Year) MANCOVA on the six SAT subtest measures, covarying on the total score on the MRT. Here, child performance was compared across three years of MAP operation, again for experienced teachers, but for teachers from three different project sites.

The final two analyses dealt more directly with the question regarding the effect of teacher MAP experience on child performance. Analysis 5 involved CAT measures on Lee County first grade children obtained in spring 1973. Ten teachers were considered: three with one year of MAP teaching experience, one with two years, one with three years, and five with four years. The five teachers considered in Analysis 6 had taught in the Gulfport MAP for one year (three teachers), for three years (one teacher), and for four years (one teacher) by the spring of 1973.

Descriptive information on the teachers involved in each analysis is presented in Table 1.

Table 1

Description of Teachers

Analysis		No. Tchrs.	Median No. Yrs. Tchg.	Median No. Yrs. in MAP	Median Age	Academic Degree[a]
1	1971-72	2	1	1	26	2B
	1972-73	3	2	1	26	3B
2		5	33	4	60	4B, 1M
3	1970-71	5	16	1	47	4B, 1M
	1971-72	5	8	1	29	5B
	1972-73	3	2	1	27	3B
4	Pickens	2	42	4	64	2B
	McCormick	1	4	4	28	1B
	Gulfport	1	26	4	55	1B
5	1 yr.	3	2	1	26	3B
	2 yrs.	1	2	2	26	1B
	3 yrs.	1	7	3	30	1B
	4 yrs.	5	33	4	61	4B, 1M
6	1 yr.	3	2	1	27	3B
	3 yrs.	1	19	3	64	1B
	4 yrs.	1	26	4	55	1B

[a]

B=Bachelor Degree
M=Masters Degree

Results

Analysis 1

The purpose of this analysis was to determine if the academic performance of first grade Lee County children taught by beginning MAP teachers depends upon the number of years MAP was in this community. The results indicated that the adjusted group criterion mean vector, based on 32 children, for the third year, (1971-72) was significantly different from the adjusted criterion mean vector, based on 54 children, for the fourth year, (1972-73) (a transformation of Wilks' lambda statistic yielded F=7.363, df=8/76; p <.001). Squares of correlations between the achievement measures and the single linear discriminant function (LDF) indicated that Language Usage and Structure was the best discriminator, followed in order by Language Auding, Mathematics Concepts and Problems, and Reading Vocabulary. Without exception the adjusted means were higher for the third year. (See Table 2.)

Table 2

Analysis 1

Performance of First Graders with Different Beginning MAP Teachers Over Third and Fourth Years of MAP Operation in Lee County

Measure	Adjusted Means		Discriminator Versus
	1971-72 (n=32)	1972-73 (n=54)	LDF Correlation Index
Reading Vocabulary	71.93	65.20	0.17
Reading Comprehension	8.22	7.32	0.02
Mathematics Computation	28.78	26.94	0.02
Mathematics Concepts and Problems	34.51	29.90	0.20
Language Auding	9.22	7.19	0.23
Language Mechanics	17.96	16.76	0.01
Langauge Usage and Structure	12.17	9.10	0.44
Langauge Spelling	8.06	6.43	0.08

Multivariate F-value: 7.363 (df= 8 and 76)

Analysis 2

The purpose of this analysis was the same as for Analysis 1, except that one set of experienced teachers was considered across the two years. The MANCOVA yielded a significant separation between the two Year groups represented by samples of 92 and 96 children in the third year (1971-72) and in the fourth year (1972-73), respectively ($F = 4.536$, $df = 8/178$; $p < .001$). The measure that contributed most to the separation was Mathematics Concepts and Problems, followed by Language Mechanics, Language Usage and Structure, and Mathematics Computation. The basic results are given in Table 3. The mean performance level for the best discriminator was higher (significantly in a univariate sense) for the fourth year group, as was the case for the third best discriminator, Mathematics Computation. However, the mean performance level for each of the two language tests - the second best discriminators - was slightly higher for the third year group.

Table 3

Analysis 2

Performance of First Graders with Same Experienced MAP Teachers
Over Third and Fourth Years of MAP Operation in Lee County

Measure	Adjusted Means		Discriminator Versus LDF Correlation Index
	1971-72 (n=92)	1972-73 (n=96)	
Reading Vocabulary	72.54	71.15	0.02
Reading Comprehension	9.60	9.23	0.01
Mathematics Computation	29.34	31.32	0.10
Mathematics Concepts and Problems	32.33	34.71	0.21
Language Auding	9.59	9.84	0.01
Language Mechanics	19.70	17.70	0.12
Language Usage and Structure	11.73	10.76	0.12
Language Spelling	8.30	7.72	0.03

Multivariate F-value: 4.536 (df = 8 and 178)

Analysis 3

The purpose of this analysis was the same as for Analysis 1 except that first grade children from Gulfport were considered. The MANCOVA yielded highly significant differences among the three groups on means of the six measures considered simultaneously (F = 36.625, df = 6/259; p <.001). Both LDFs were significant; thus the sum of the two squared discriminator - LDF correlations was used as an index of relative contribution for each predictor (Huberty, 1975). As seen from Table 4, Arithmetic, Word Study Skills, and Spelling measures were the top discriminators, with Paragraph Meaning and Word Reading next best. It may be noted that for the best discriminator, mean performance level for the fourth year (1972-73) was highest, after a "dip" in the third year (1971-72). For the second best discriminator, Word Study Skills, the 1972-73 mean was about the same as for the second year (1970-71), while mean performance in Spelling did not quite "bounce back" in 1972-73 following the decrease in 1971-72.

Table 4

Analysis 3

Performance of First Graders with Different Beginning MAP Teachers Over Second, Third, and Fourth Years of MAP Operation in Gulfport

Measure	1970-71 (n=103)	1971-72 (n=91)	1972-73 (n=74)	Discriminator Versus LDF Correlation Index
Word Reading	16.25	12.38	16.76	0.46
Paragraph Meaning	15.09	11.30	13.20	0.58
Vocabulary	17.62	16.44	17.21	0.09
Spelling	9.08	5.39	7.39	0.65
Word Study Skills	30.66	24.63	30.59	0.66
Arithmetic	33.28	26.69	36.27	0.74

Multivariate F-value: 36.625 (df = 6 and 259)

Analysis 4

The purpose of this analysis was to determine the effect of the number of years of MAP operation in a community on the academic performance of first grade children when one set of experienced teachers was considered across the years for each of three communities. The two-way MANCOVA yielded a significant F-value for Site-by-Year interaction of 4.100 (df = 24/915; p <.001). Three significant LFDs resulted for the interaction effects. Based on the sum of three squared discriminator-LDF correlations, Paragraph Meaning and Word Study Skills contributed most to the overall interaction (see bottom of Table 5) - this finding was supported by the large univariate F-values for these two discriminators. Since the interaction effects appeared real, it was decided to investigate Year effects for each of the three sites separately.

The variables that contributed most to the differential Year effects varied across sites. For Pickens, Arithmetic appeared as contributing most to the significant (F = 3.013, df = 12/270; p <.001) Year effects, with Paragraph Meaning and Vocabulary next. For each of these three measures mean performance peaked in the third year (1971-72), with the Arithmetic mean in the fourth year (1972-73) falling somewhat below that of the second year (1970-71). For McCormick, the two measures contributing most to the significant (F = 8.416, df = 12/112; p <.001) Year effects were Word Study Skills and Paragraph Meaning. Again, the third year (1971-72) produced the peak mean performance on these two subtests. For Gulfport, Paragraph Meaning was clearly the best contributor to the significant (F = 3.285, df = 12/118; p <.001) Year effects, with Word Reading the next and only relatively important measure. The fourth year (1972-73) produced the highest mean performance level for both of these measures, with the level somewhat higher than the first two years for Paragraph Meaning and the same as the first year for Word Reading following a drop in the second year.

TABLE 5

Analysis 4

Performance of First Graders with Same Experienced MAP Teachers Over Second, Third, and Fourth Years of Operation in Three Sites

		Adjusted Means[a]			Discriminator Versus LDF Correlation Index for One-Way Analysis
		1970-71 (n=50)	1971-72 (n=41)	1972-73 (n=53)	
Pickens	WR	24.68	24.63	21.66	0.45
	PM	21.64	26.29	21.67	0.67
	VO	20.09	22.72	19.50	0.66
	SP	15.20	16.40	14.78	0.20
	WS	30.02	40.83	37.91	0.20
	AR	42.06	43.56	36.30	0.78
		(n=22)	(n=20)	(n=23)	
McCormick	WR	14.34	16.67	14.01	0.05
	PM	12.68	17.43	8.63	0.54
	VO	15.29	21.88	16.60	0.16
	SP	8.48	9.62	10.53	0.02
	WS	26.27	40.06	31.18	0.57
	AR	30.02	35.18	28.72	0.12
		(n=22)	(n=22)	(n=24)	
Gulfport	WR	19.47	14.27	19.78	0.78
	PM	10.10	9.86	17.36	0.92
	VO	18.47	18.11	18.74	0.03
	SP	8.27	6.98	11.15	0.34
	WS	33.67	30.75	36.76	0.32
	AR	32.51	27.86	35.88	0.24

	Discriminator Versus LDF Correlation Index for Interaction
[a] WR = Word Reading	0.75
PM = Paragraph Meaning	0.92
VO = Vocabulary	0.29
SP = Spelling	0.65
WS = Word Study Skills	0.86
AR = Arithmetic	0.70

Analysis 5

The purpose of this analysis was to determine how academic performance of first grade children from Lee County varies with teacher MAP experience. The MANCOVA yielded an F-value of 5.103 (df = 24/479; p <.001). Three significant LDFs resulted; the variable contribution index (sum of three squared discriminator-LDF correlations) revealed that Mathematics Computation and Language Auding were no doubt the best discriminators. (See Table 6.) Generally mean performance level peaked for teachers with three years of MAP experience; the only exceptions were with Reading Comprehension and Language Usage and Structure, both relatively poor discriminators.

Table 6

Analysis 5

Performance of First Graders with Teachers Having One to Four Years of MAP Teaching Experience in Lee County

Measure	Adjusted Means				Discriminator Versus LDF Correlation Index
	1 Yr. (n=54)	2 Yrs. (n=18)	3 Yrs. (n=10)	4 Yrs. (n=95)	
Reading Vocabulary	66.66	74.58	76.70	70.66	0.25
Reading Comprehension	7.62	8.59	7.24	9.14	0.20
Mathematics Computation	27.94	27.15	38.61	30.98	0.78
Mathematics Concepts and Problems	31.06	32.28	36.32	34.33	0.30
Language Auding	7.42	9.48	10.75	9.78	0.68
Language Mechanics	17.69	15.20	22.04	17.19	0.19
Language Usage and Structure	9.63	12.38	11.97	10.64	0.27
Language Spelling	6.89	8.61	8.38	7.57	0.06

Multivariate F-value: 5.103 (df = 24 and 479)

Analysis 6

The purpose of this analysis was the same as that of Analysis 5 except that teachers and children in Gulfport were considered. The six SAT subtest and measures (covarying on MRT scores) yielded a MANCOVA F-value of 4.996 (df = 12/178;

p <.001). Squares of discriminator versus the lone significant LDF correlations indicated that Word Study Skills and Spelling were the only apparent discriminators, with the possible exception of Paragraph Meaning (see Table 7). For the three top discriminators greatest meaning gains resulted for a teacher with three years of MAP experience versus teachers with one year of MAP experience.

Table 7

Analysis 6

Performance of First Graders with Teachers Having One, Three, and Four Years of MAP Teacher Experience in Gulfport

Measure	Adjusted Means 1 Yr. (n=58)	 3 Yrs. (n=16)	 4 Yrs. (n=24)	Discriminator Versus LDF Correlation Index
Word Reading	16.89	17.41	19.24	.02
Paragraph Meaning	12.67	15.94	16.51	.17
Vocabulary	17.44	16.94	18.15	.00
Spelling	6.88	12.37	10.80	.35
Word Study Skills	29.07	37.76	36.07	.46
Arithmetic	37.49	34.59	34.62	.04

Multivariate F-value: 4.996 (df = 12 and 178)

Summary of Results

Analyses 1 through 4 dealt with investigations of the effect of the number of years that MAP was in operation in a particular community on the achievement of first graders.

Analysis 1. In Lee County, with first year MAP teachers, the third year of operation (1971-72) produced group mean scores higher than the fourth year, with two language measures and a mathematical measure contributing most to the difference.

Analysis 2. In Lee County the children of experienced MAP teachers in the fourth year of program operation (1972-73) produced a higher group mean performance level on a measure of mathematics achievement, the best discriminator, than they did in the third year.

Analysis 3. In Gulfport, with different first year MAP teachers, the third year of operation (1971-72) yielded lowest mean levels of child performances for all measures. For the best discriminating measure of Arithmetic, the fourth year (1972-73) was best; for Word Study Skills, the second (1970-71) and fourth years were about the same; while for Spelling, the second year appeared best.

Analysis 4. With experienced MAP teachers, the year yielding highest group means on the best discriminators varied somewhat across sites. In Pickens, and McCormick Counties the third year (1971-72) of MAP operation was tops for the best discriminators. In Gulfport the fourth year (1972-73) of MAP operation yielded the highest group mean on the best discriminating measure (Paragraph Meaning), while the second (1970-71) and fourth years yielded about equally high group means on the other good discriminator (Word Reading).

In summary, the performance of children of different first year MAP teachers in the third year of MAP operation differs from highest in Lee County to lowest in Gulfport. For experienced MAP teachers the third year was best in Pickens County and McCormick County while the fourth year was tops in Gulfport and Lee County.

Analyses 5 and 6 dealt with investigations of the effect of the number of years of teacher MAP experience on the achievement of first graders. For the number of years considered, in both Lee County and Gulfport the group means on the best discriminators were highest for teachers with three years of MAP teaching experience. The best discriminators for Lee County were Mathematic Computation and Language Auding; for Gulfport they were Word Study Skills and Spelling.

Discussion

The performance on an achievement test by a given group of first grade children may be affected by any one or more of a number of factors. Furthermore, comparisons of performance levels among two or more groups may be distorted because of differential effects of various extraneous factors on the groups. In the present investigation an attempt was made to control some confounding factors. Different pre-first grade achievement levels across groups within each analysis were considered by statistically removing readiness performance (as measured by the MRT) from the criterion achievement performance. Also, in attempting to look at program maturity in terms of the effect of the number of years of MAP operation, separate analyses were conducted holding MAP teacher experience constant while studying performance levels in different sites. A similar approach was used while investigating program maturity in terms of the effect of MAP teaching experience on child performance.

Some limitations on data available precluded a more detailed study of the program maturity problem. For example, lack of data due to teacher turnover restricted the analyses to a fewer number of years than would be desirable. Also, the use of different achievement tests across some sites precluded the combination of some analyses.

There are some extraneous variables that come into play when studying effects on child performance which are very often all but impossible to control. A number of such variables can be pointed out that might have had an effect on the results of this investigation. As it is with most, if not all, educational change programs, implementation of the Mathemagenic Activities Program in the various sites has not been ideal. Change in personnel is a big deterrent to the smooth operation and continued improvement in implementation. During the years of concern in this study (1970-1973), personnel changes resulted at many levels: local school administrators, kindergarten as well as first grade MAP teachers, local MAP administrators, and various field staff people of the MAP-FT sponsor. Other changes might have also affected the performance of teachers and/or children. The in-service teacher training programs of the MAP-FT sponsor have undergone planned changes in approach toward activity based curricula and teacher strategy as well as in its field training personnel. Changes in the local community educational-political leadership climate had noticeable effects which are not determinable so far as teacher and/or classroom performance are concerned.

In spite of the above problems and difficulties, useful information, or indicators, can be teased out of the results of the current study. First of all, the results indicate that beginning MAP teachers elicit top average group performance of first graders at the end of the third or fourth year that MAP has been in operation in a community. Now it may be that a factor contributing to this result was that the in-service training of teachers reached a point of high efficiency at the beginning of the third or fourth years. The third (predominantly) and fourth years of MAP operation also yielded the best child performance, on the average, for experienced teachers. As with beginning teachers, it cannot be definitely stated that the cause of the top performance was the number of years MAP was in operation; other (unknown) variables undoubtedly made some contribution to the obtained results.

Secondly, the results indicate that teachers who have completed three years of MAP teaching experience appear to elicit the top average group performance of their children. Here again, other variables may have been contributing to the apparent year differences. For example, individual teacher differences may be a contributing factor, since data were available only on children of single teachers in MAP for three years in each site considered.

Finally, a look at the best discriminator measures considered in each site may reflect local emphases and changes in emphases from year to year. For example, measures of language and mathematics achievement for beginning MAP teachers in Lee County and Gulfport were the best discriminators, at the exclusion of reading measures. Reading measures were also relatively poor discriminators for Lee County experienced MAP teachers. However, reading measures were good contributors to differences in the other sites, particularly Gulfport, for experienced MAP teachers.[2] For teachers having varied numbers of years in MAP, language measures were good year-to-year discriminators in both Lee County and in Gulfport. However, a mathematics measure was the best in Lee County.

From the results of the present investigation it might obviously be concluded that more longitudinal data need to be collected and analyzed before any conclusive evidence of program maturity can be claimed. It may very well be that what has emerged are some temporary phenomena as far as peaking or leveling off of group performance is concerned.

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[2] These results may reflect variations of MAP training or in project implementation at these sites.

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2) The Use of Mathematical Models for Describing Sequential Search Strategies in Elementary School Children
Robert Lissitz, Philip Lewis, Patrick Brady

3) Measures of Language Comprehension: Relations to Performance
Rodney Cocking

4) Models for Performance in Syllogistic Reasoning
Paul Silverman

5) Elementary and Middle School Children's Comprehension of Euclidean Transformations
Richard Kidder

6) Ethology's Modest Contribution to the Assessment of Education
William Charlesworth

7) When Do We Know What a Child Knows?
Irving Sigel

8) What Should We Measure When We Measure Linguistic Competence?
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An Experiment in Compensatory Education

by

P. R. de Lacey

Wollongong University College

Paper Presented

at the

Australian Association for Research in Education
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Prepared for the
MATHEMAGENIC ACTIVITIES PROGRAM - FOLLOW THROUGH
of the
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Charles D. Smock, Director

PS 011513

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Introduction

By the mid-1960's it appeared that the cognitive gains shown by low-income American children attending Head Start and similar compensatory pre-schools began to erode or wash out in the years following their pre-schooling. Various possible plans were explored to try to arrest the "unlearning." One such plan developed was Follow Through.

Follow Through is a research and development program for children (kindergarten or first grade through the third grade) from low-income families. Forty community projects were authorized in 1967 until Title II of the Economic Opportunity Act and the program was expanded to include 150 projects by 1971-72 with more than 78,000 children enrolled. More than 80 percent of the children were from low-income families, as judged by the Federal Guidelines Poverty Index.

Twenty-two agencies and/or institutions of higher education which have developed different models of early childhood education serve as Sponsors; i.e., "change agents." Thus, Follow Through is organized as a partnership with the community educational system (LEA), the Sponsor, and the Federal Follow Through Office, each participating in the decision-making and implementation of the program. Follow Through is primarily financed by the Federal Government, with the local community contributing approximately 20 percent of the support.

Each Follow Through Program must be comprehensive in scope and must meet the needs of children pertaining to child development and learning. These needs include academic instruction, medical and dental health, nutrition, psychological services, social services, staff development and career advancement. Each of these components must be an integral part of the overall Follow Through Program. The specific objectives of Follow Through are:

1. To promote learning in disadvantaged children.

2. To promote development of the "whole" child by providing the adequate medical, dental, nutritional, psychological and social services often not available to children from low-income families.

3. To involve the parents in their child's education, through parent participation in the education system* and the classroom learning experience.

4. To promote career development opportunities for low-income parents and staff development for the teachers.

University of Georgia Model

This report is mainly concerned with one of the 22 Sponsors associated with the National Follow Through effort. The University of Georgia model is known as the Mathemagenic Activities Program (MAP), was developed by Professor C. D. Smock (Department of Psychology), and has been adopted by communities in Georgia, South Carolina, Mississippi, Virginia, Ohio and Idaho. Mathemagenic means "give birth" (genic) to learning (mathma); thus mathemagenic activities refer to the coordinated actions requiring stimulation in order to provide the individual with an opportunity to construct a coherent interpretation of his physical and social environments. Mathemagenic activities refer, then, to both practical (overt actions) and "mental" (thinking) activities. Concrete and manipulative materials are utilized as a means for providing the conditions that evoke and expand sensory-perceptual memory and thinking processes characteristic of a child appropriate for each stage of development.

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* The Policy Advisory Committee (PAC) for each project must be composed of 50% low-income parents and the remainder representatives of community agencies concerned with the welfare of children.

In its classroom structure, MAP requires two instructional aides, in addition to the teacher, in order to provide a high level of social interaction in small group instructional task situations. The instruction strategy involves both teacher-selected and pupil-selected (independent) activities. The physical, as well as the recommended social, arrangement of the MAP classroom encourages the operation of several small groups simultaneously. All classrooms are carpeted (to reduce noise level) and have been provided with all additional materials and equipment necessary to provide a great variety of appropriate learning activities.

The MAP organization provides preservice and in-service workshops for training resource teachers, teachers and aides in the implementation of the program. In addition, there is an on-going in-service program for all personnel, including those in administrative support services.

The major curriculum emphasis in MAP is on the teaching strategies (i.e., process approach) but specific texts and activities, for grades K through 3, have been developed and/or recommended for language arts, mathematics, science, social studies, art, music, physical education and health.

The MAP Sponsor considers participation in planning with each community, each year, in writing their project continuation proposals. This process includes an assessment of community and educational resources; consideration of qualifications for staffing the project; an analysis of curriculum materials, equipment and supplies; determination of procedures for evaluation of the program impact on children, teachers, parents and other representatives of the total community (Agency representatives, LEA members, PAC members, etc.); and expected in-service plans of both MAP and community project leaders (e.g., resource teachers' activities for teaching training). The planning also involves the development, in cooperation with the community, of a decision-making strategy that stresses input from relevant "stakeholders" (e.g., PAC, parents, teachers, principals) within the local educational system. Special emphasis is placed by MAP on the development of local leadership for all components of the project. The training proceeds sequentially with local leaders assuming more and more of the major responsibilities of program implementation. Gradual replacement of the MAP Sponsor staff with local staff is expected over a period of 3-5 years.

Evaluation of Follow Through

Most Follow Through programs are oriented toward improving school achievement and, thus, tests of academic achievement figure prominently in most of the evaluation efforts. However, since the Federal Office, each Sponsor and each project all are conducting some form of evaluation*, a large variety of measure of impact of the total program will be available at the end of the research effort. The MAP program, for example, has collected data on both academic achievement (e.g., SAT) and more general cognitive competencies relevant to problem-solving skills. The study of Follow Through and non-Follow Through children in the MAP program reported in this paper is an example of the latter type of evaluation. Data were collected between November 1972 and February 1973 in Pickens County, Georgia; McCormick County, South Carolina; and Gulfport, Mississippi. The children were randomly selected from MAP classroom so as to obtain equal numbers of 6-, 8-, and 10-year-old children. A total of 538 children, about equal numbers of boys and girls, low-income and non-low-income, black and white, participated (see Table 1).

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* Role in evaluation of National, Sponsor, and project SRI publications.

Table 1

Distribution of Children in Either Programme by Race and Income

	Black						White					
	Low		Non-Low		Total		Low		Non-Low		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
FT	117	88.6	15	13.4	132	100	81	58.3	58	41.7	139	100
NFT	73	67.9	43	37.1	116	100	19	12.6	132	87.4	151	100
Total	190	76.6	58	23.4	248	100	90	32.1	180	67.9	290	100
											538	

The purpose of the study was to contribute to a broader evaluation of the impact of the program on children's cognitive development and to add to data previously gathered in Australia on a similar population.

The test battery included the following tests:

Peabody Picture Vocabulary Test (PPVT)

Raven's Colored Progressive Matrices (RPM)

Inhelder and Piaget Matrices (I&PM)

Nixon Test

Three subtests of the Illinois Test of Psycholinguistic abilities (IRPA):

- Auditory Association
- Verbal Expression
- Grammatic Closure

The PPVT and the RPM were administered according to the standardized procedures, whereas the I&PM and Nixon Matrices were administered according to procedures described in an earlier paper (de Lacey, 1970). The three ITPA subtests were chosen because they have proved the most sensitive of all

ITPA subtests to differences between high and low income and between children who have experienced compensatory preschooling and those who have not (Nurcombe, Moffitt and de Lacey, 1972).

A problem in this study, which is shared with most evaluations of Follow Through, was the difficulty of maintaining an adequate experimental design. Children in Follow-Through classrooms were generally, by definition, children from the lowest income families. Non-Follow Through samples included some higher-income children and would be expected to score significantly higher in most measures involving cognitive abilities.[1] Thus, any finding of no difference between performances of Follow Through (FT) and Non-Follow Through (NFT) samples could plausibly be interpreted as a "positive" finding in terms of a favorable impact of the program on Follow Through children.

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[1] See U. S. DHEW Publications No. (HSM) 72-1011 and (HSM) 72-1012.

Results

The results of all possible comparisons are shown in Tables 2 through 8. The FT program has not arrested the decline in performance between ages six and ten of the labelling and presumed inferential abilities tapped by the PPVT; the performance of the NFT sample, as expected, remained steady on this measure.

On the Raven's and Inhelder & Piaget Matrices, however, the FT children maintained the level of the Non-FT children. The RPM and the I&PM include similar tasks, except that the I&PM requires the defining criteria for the solutions to be stated.

Among the ITPA subtests, a similar and moderate loss in scaled scores was recorded by the FT and the NFT group. The loss tended to be a little greater for the FT (though the t was not significant) on the Grammatic Closure test.

A comparison between the above U. S. and our Australian data is given for the I&PM in Table 9 and the Nixon Test in Table 10. Both tables show that, for a disadvantaged group, the FT are performing relatively well on these areas of cognitive functioning.

In summary, this survey has shown that the MAP model of Follow Through appears to have staved off the expected cumulative performance deficit for the FT children in the non-verbal areas measured. There is, however, still an accumulating deficit overall in some of the verbal areas with pooled results of the three communities studied. Further, and more detailed, analysis of these data should clarify the interpretive significance of the variation in impact of the FT-MAP program on the different cognitive abilities assessed in this study.

Table 2

PPVT Scaled Scores

	FT			NFT		
Age	N	Mean	SD	N	Mean	SD
6	88	87.43[1]	17.24	91	90.89[1]	16.39
8	94	88.72	14.74	87	93.29	16.73
10	83	83.60[2]	17.59	76	90.71[2]	17.76

[1] $t = 1.37$, $p > .05$

[2] $t = 2.53$, $.05 > p > .01$

Table 3

RPM Raw Scores

	FT			NFT		
Age	N	Mean	SD	N	Mean	SD
6	88	13.44	4.25	91	15.06	3.78
8	93	18.94	6.16	87	19.81	6.05
10	83	24.30	6.49	78	24.86	6.19

Table 4

I & P Matrices Raw Scores

	FT			NFT		
Age	N	Mean	SD	N	Mean	SD
8	93	3.47	2.26	86	3.77	2.62
10	82	4.94	2.42	81	4.99	2.10

Table 5

Nixon Raw Scores

	FT			NFT		
Age	N	Mean	SD	N	Mean	SD
6	88	3.12	1.59	91	2.60	1.58
8	92	4.23	1.48	88	4.52	1.55
10	20	5.40	0.94	23	4.91	1.38

Table 6

ITPA Auditory Association Scaled Scores

	FT			NFT		
Age	N	Mean	SD	N	Mean	SD
6	86	31.80	8.51	91	30.63	9.65
8	94	29.30	9.13	80	32.30	9.41
10	82	28.37	9.02	75	28.41	11.84

Table 7

ITPA Verbal Expression Scaled Scores

	FT			NFT		
Age	N	Mean	SD	N	Mean	SD
6	88	32.04	4.37	91	31.15	4.20
8	93	27.18	4.02	87	27.24	3.72
10	83	25.69	3.04	76	26.04	3.61

Table 8

ITPA Grammatic Closure Scaled Scores

	FT			NFT		
Age	N	Mean	SD	N	Mean	SD
6	82	33.83	8.50	90	34.92	7.75
8	94	29.76	8.75	87	33.04	8.21
10	83	26.61	11.38	76	29.99	10.30

Table 9

Australian and US I&PM Mean Raw Scores

	US		AUST		
Age	FT	NFT	HA[1]	LE[2]	HE[3]
8	3.47	3.77	0.30	1.56	2.76
10	4.94	4.99	2.58	2.64	4.56

[1] High-contact Aboriginals

[2] Low-income Europeans

[3] High-income Europeans

Table 10

Australian and US Mean Nixon Raw Scores

	US		AUST		
Age	FT	NFT	HA[1]	LE[2]	HE[3]
6	3.12	2.60	1.20	2.10	4.68
8	4.23	4.52	3.00	4.32	4.98
10	5.40	4.91	4.68	4.62	5.70

[1] High-contact Aboriginals

[2] Low-income Europeans

[3] High-income Europeans

Discussion

There are other data besides scores on tests of cognitive development or school achievement that need to be considered in evaluating programs like Follow Through. It would be as premature to judge the success of Follow Through only on the basis of these measures as it already has been for some evaluations of Head Start to have done. Neither Follow Through nor Head Start should be described as failures at this time.

In an appraisal of Follow Through, Stallings (1973) argues that Follow Through has succeeded, specifically by providing for participating children a wider variety of activities, more individual attention, and more constructional materials; FT children receive more praise for accomplishments, and respond by showing more verbal initiative more often solving their own problems, responding more to teacher questions and requests, and being more independent. NFT children, by contrast, are more often taught in large groups, more often teach each other and are more often punished.

Follow-up studies over several years will also need to be made not only of the children who have belonged to classrooms of the various Follow Through models, but also the younger sibs of these children.

It cannot be that any failure of Follow Through is the reason why the American executive is phasing the program out over the next few years. Follow Through was first conceived as an experiment, so that the possibility of its terminating in its present form was always open. It is an experiment that very much merits the serious attention of those of us in Australia who are interested both in innovation and research in compensatory education.

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Salient Points of Paper

1. The erosion or washout phenomenon has been observed to occur widely after compensatory preschool education, such that by the middle of the primary school years children who have been to compensatory preschools score no better on cognitive tests than similar children who have not. The washout phenomenon, however, occurs most with short (e.g., summer) preschools, somewhat with year-long programs with some home involvement, e.g., Burke, and least with year-long programs with substantial home involvement, e.g., Levenstein's.
2. One attempt to counter the washout effect by attempting to consolidate and extend the gains made by Head Start-type preschools is Follow Through, which is an R & D program for low-income children who have had Head Start. A federally funded experiment.

   Essential characteristics:

   Managed by a sponsor whom a given community has selected.

   Adequately funded (e.g., $2 million annually for a project with 6 communities).

   Each community must have 80% poverty children.

   Children catered for from K or Grade 1 through Grade 3.

   Incorporates total welfare provisions.

   Is at the same time a social action program - difficulties for experimental design.

   Provides teacher training and continuing in-service workshops.

   Duplicates, then gradually hands over, management to local communities.

   Policy Advisory Committees, made up of local parents and residents, can call management to account.

Incorporates curriculum design, advisory, research and evaluation components.

Introduces changes in classroom: e.g., More materials
Teacher aides
Carpets and furnishings
Different curriculums

Purpose of my study:

Contribute to Follow Through evaluation

Expand data gathered in Australia to allow comparisons US/Aust.

Test battery:

PPVT
ITPA AA, VE GC
Nixon Set 6 & 8, and a few 10
I&P Matrices Set 8 and 10
RPM

Results Show graphs

Discussion:

Washout and cumulative deficit apparently arrested by this program in some areas.

Still loss in some verbal areas, however.

FT behind on: PPVT
Grammatic Closure

FT same on: RPM
I&PM
AA
VE
Nixon

An encouraging result considering NFT include most of any high-income children in a given community.

PS 011513

Mathemagenic Activities Program

Follow Through Project Evaluation Report

Gulfport, Mississippi

Prepared by Joseph H. Porter[1]

March 1975

Mathemagenic Activities Program
University of Georgia Follow Through
Charles D. Smock, Director
Paul Silverman, Evaluation Coordinator
Nancy Graham, Field Operations Coordinator

This report is based on activities supported (in part) by the Mathemagenic Activities Program-Follow Through, C. D. Smock, Director, under Grant No. OEG-0-8-522478-4617 (287) Department of HEW, U. S. Office of Eudcation. However, the opinions expressed herein do not necessarily reflect the position or policy of the U. S. Office of Education, and no official endorsement by the U. S. Office of Education should be inferred.

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[1] Portions of this report are based on prior work by Cathy Jones for which we are grateful. Appreciation also is expressed to MAP staff, to the Gulfport Project Staff (Alice Smith Director) and to the teachers and children in the Gulfport education system.

Errata Errata

Gulfport Project Report

This report had gone to press before it was discovered the achievement tests in spring 1972 and 1973 were administered over a three day rather than over four (SAT-P1), six (SAT-P2) or seven (SAT-Int.) day period. The Silverman et al. (1974) study compared the achievement data of FT and NFT children to national norms and these results may be biased in that this administrative artifact could have produced a relative loss in achievement. Similar caution should be used in interpreting the results presented on page 7 (Cohort II) and on page 8 (Cohort I) of this report.

Foreward

In 1969 the Mathemagenic Activities Program (MAP) was funded as a sponsor in the Follow Through Program (FT), a national experiment to produce educational models designed to enhance the development of young children from low-income families. With the cooperation of the communities it served, MAP-FT began its evaluation program that year. Standardized readiness and achievement tests were administered to FT and non-FT children upon entry in school and at various points during their enrollment. In 1970, "special studies" concerned with underlying theoretical issues were initiated to assess: (1) the patterns of cognitive development of children in MAP projects; and (2) the particular influence of the MAP Classroom Learning Environment on aspects of cognitive development. To date, measures of children's competencies in a variety of areas have been used in addressing issues such as: the impact of kindergarten on children's subsequent performances, the effect of factors beyond direct control of the sponsor (e.g. readiness level, income level), the performance of children after they leave the program, and the impact of the number of years of teacher experience with MAP on achievement. Many of the studies involved are still in process, while others have been completed and published as MAP Reports, Bulletins, and Newsletters. Most of the published studies have focused on research designed to describe MAP effects in general rather than MAP effects in specific communities. Much of that research, however, is of special interest to each project and we hope this report contributes useful information to all those concerned with the education of young children in your community.

C. D. Smock, Director
Mathemagenic Activities Program

Preface

This Project Evaluation Report is a compendium of previously published material, preliminary findings of ongoing research, and data analyzed expressly for the report. It is one of a series of reports designed to yield information which each community can use in assessing the strengths and weaknesses of Follow Through as it is locally implemented. In general, a number of studies suggest that while there are community differences, MAP-FT is achieving its goals. As is indicated in the following text, the conclusion from any research findings depends partially on the objectives of the interpreter. In concluding that the program is "good" because it is meeting its goals, the staff of MAP-FT do not wish to imply that other educational methods are "bad." The other methods may simply be influencing children in beneficial ways not measured by MAP. Similarly, reports of "high" and "low" scores may be interpreted in a variety of ways. A program which produces high spelling scores may consider itself a failure if, ideally, its teachers should have spent a small amount of time teaching spelling. A program which produces low scores in "cognitive" measures of ability to understand may consider itself a success, if the chief goal is to produce "factual" knowledge rather than to enhance the growth of more general intellectual abilities.

This series of Project Evaluation Reports could not have been generated without the cooperation of each of the local communities involved. The staff of MAP-FT wish to thank the project staffs, teachers, and children who have participated in the collection of data and who have provided many insighful criticisms incorporated in the final drafts.

C. D. Smock, Director

P. Silverman, Evaluation Coordinator

Abstract

This report is a preliminary summary of results of the Mathemagenic Activities Program-Follow Through (MAP-FT) Project in Gulfport, Mississippi. Most of the comparisons between FT and NFT children were based upon achievement test data and show that the FT children entered the first grade at a level of achievement which was lower than that of NFT children. By the end of the third grade, however, the academic performance of the FT children was comparable to that of NFT children, and in some cases actually surpassed that of the NFT children. The achievement gains of the FT children were also shown to be present in the fourth grade after the children had "graduated" from the FT program. Non-verbal intelligence tests have indicated that the performance of FT and NFT children is similar. One study using these tests has shown that MAP-FT was successful in modifying the relationship between environmental conditions outside the classroom and the child's cognitive abilities, thus allowing the MAP-FT classroom environment to exert a greater influence on those abilities. The results of the present report provide tentative but encouraging support for the effects of the Gulfport MAP-FT project.

Mathemagenic Activities Program-Follow Through
Project Evaluation Report: Gulfport, Mississippi

This report is a preliminary summary of results of the Mathemagenic Activities Program-Follow Through (MAP-FT) Project in Gulfport, Mississippi. This is not intended in any sense to be a final report, but is designed to summarize those results from studies which are completed and those results from ongoing and uncompleted studies where those data are available. In some cases, there is a lack of matched comparison groups (i.e., Non-Follow Through students). Where this occurs, the results can not be used to judge the "success" or "failure" of Follow Through. Another limitation is that most of the data are standardized achievement tests. MAP-FT is a process-oriented model which attempts to influence the level and rate of cognitive development as its primary objective. The interpretation of achievement test results, therefore, needs to be qualified since achievement test scores offer only an indirect measure of the success of the program; that is, high scores on such tests do not necessarily mean that MAP-FT is a success; nor do low scores indicate failure. It is hoped, of course, that FT achievement scores will not fall below those of NFT counterparts but, more importantly, that any achievement gains shown by FT children reflect gains in general cognitive and problem solving abilities.

This report is intended for a general audience who may, or may not, be familiar with educational research and evaluation. Therefore, explanatory material has been included in footnotes and parentheses where appropriate. In addition to this report, a Project Evaluation Report has been prepared by Alice Smith, Director, Follow Through Program, Gulfport Public Schools. In general, the results of that report agree with those presented here.

Community Description

Gulfport, Mississippi is a Gulf coast community with approximately 45,000 residents. The 1970 census shows that the Gulfport population includes 18% black people, but the school system records 27% of the children as black. The average family income of $7,800 is low by national standards, but is higher than the Mississippi state average. A nearby Air Force installation is a chief source of industry for the community, in addition to the deep-water harbour industries, fishing, tourism, and the retail trade of the business center. The school system provides classes for grades 1 to 6 at elementary schools, grade 7 to 9 at middle schools, and grades 10 to 12 at high schools. Except for a Head Start program, kindergartens are not generally available. A more complete description of the Gulfport, Mississippi community may be found in de Lacey & Smock, 1974b and Wortman and Mann Inc., 1972.

MAP Classroom Description

The learning environment of Mathemagenic Activities Program-Follow Through (MAP-FT) classrooms is designed according to the principle that optimal conditions for developmental-intellectual change require an appropriate discrepancy between previously acquired knowledge and environmental-task demands. Thus, sequentially structured sets of curriculum materials and processes are designed so that continual "challenges" to learn are provided. The recommended curriculum materials make it possible for the teacher to set up a learning environment consistent with the MAP principles of: (a) mismatch, or appropriate structuring of the child's physical and social environment and learning units that are slightly above his prior conceptual level; (b) self-regulation promoted by "learning territories" which encourage instructional strategies that provide for appropriate variation in modes of learning as well as balance between highly structured and relatively low structured learning situations and between group and individual learning activities; and (c) coordinated activities by which children learn by active manipulation of their physical, social and symbolic environments. In addition, the "interlocking" nature of the different curriculum contents (e.g., overlap of Science, Art, and Language) creates possibilities for development of intellectual processes and skills through a variety of media, activities and social situations. In its classroom structure, MAP requires two instructional aides, in order to provide a high level of social interaction in small group instructional task situations.

Entering Characteristics of FT and NFT students

As can be seen in Table 1, the majority of FT students come from low income families, while the majority of the NFT students come from non-low income families.[2] This situation is typical for most FT and NFT project samples, and it would be expected that the NFT students would score significantly higher on most measures involving cognitive abilities (de Lacey & Smock, 1974a). Table 2 supports the contention that the FT students have

Table 1

Percentage of FT and NFT students belonging to Low or Non-low income families

Income	1969-1970		1970-1971		1971-1972	
	1st grade[1]	2nd grade[1,2]	FT	NFT	FT	NFT
Unknown	6%	8%	5%	2%	90%	96%
Low	57%	61%	61%	30%	8%	1%
Non-low	38%	31%	34%	69%	2%	3%
# of students	177	204	194	108	187	90

[1] Income data was available for FT students only.

[2] This was the first year of the MAP-FT Program for these students in the 2nd grade.

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[2] For an index of "Low-income," the reader is referred to Department of Health, Education, and Welfare, Office of Education-Follow Through Program, Washington, D. C. Federal Register 1974, No. 121, Part II.

an initial level of achievement which is lower than that of the NFT students. Metropolitan Readiness Tests (MRT) were administered each fall to provide a measure of the child's level of "readiness" to enter the 1st grade. The FT students consistently have lower scores on this measure

Table 2
Mean scores on MRT for 1st grade FT and NFT students

Subtest	Fall 1969		Fall 1970		Fall 1971	
	FT	NFT *	FT	NFT	FT	NFT
Word Meaning	5.90	--	6.18	7.49	6.64	7.38
Listening	9.29	--	8.21	9.23	8.05	9.29
Matching	5.79	--	5.98	7.51	7.32	7.82
Alphabet	8.04	--	8.53	9.56	10.06	10.52
Numbers	10.27	--	8.30	10.18	8.96	10.13
Copying	6.10	--	5.77	7.56	5.65	6.78
Total Battery	45.36	--	42.96	51.52	46.68	51.92
# of students	180		194	108	184	90

*MRT data was not collected from NFT students.

(all differences were statistically significant ($p<.05$) except for the Matching and Alphabet subtest scores in Fall, 1971).[3] Therefore, any finding of no difference between performances of FT and NFT students on measures obtained later (e.g., end of 1st grade, 2nd grade, etc.) could be interpreted as a "positive" finding in terms of the effectiveness of the MAP-FT intervention.

The Effects of MAP-FT

MAP-FT effects on children enrolled in the program.

Cohort I (entered 1st grade in Fall, 1969). A study designed to evaluate the effects of MAP-FT on the achievement level, (of Follow Through children), was determined by standardized achievement tests, was completed in 1974 (Silverman, Favata, Ebert, & Smock, 1974). The sample consisted of 110 FT children (100% low income) and 75 NFT children (33% low income). The data consisted of subtest scores from the Spelling, Word Study Skills, and Arithmetic Computation subtests of Stanford Achievement Tests (SAT) (administered Fall, 1970-2nd grade; Fall, 1971-3rd grade; and Spring, 1972-3rd grade).

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[3] Differences between means are judged to be "statistically significant" when those differences can be expected to occur by chance only 5 times out of 100.

The results indicated that both FT and NFT low income children showed a loss in relative achievement as compared to national normative groups, when entry scores (Fall, 1970) are compared to the exit scores (Spring, 1972). When the achievement scores of FT and NFT low income children were compared with those of NFT non-low income children, the NFT low income group displayed a steadily increasing cumulative deficit in achievement performance relative to the NFT non-low group. Follow Through children (low income) however, maintained their achievement level relative to NFT non-low children--the differences between these two groups did not increase (i.e., no cumulative deficit).

Cohort II (entered 1st grade in Fall, 1970). The influence of MAP-FT on achievement test results was also examined for Cohort II children. A longitudinal sample for grades 1-3 consisted of 86 FT and 33 NFT children. The Metropolitan Readiness Test (MRT) was administered Fall 1970 (1st grade); the Stanford Achievement Test (SAT) Primary I was administered Spring 1971 (1st grade); the SAT P2 was administered Spring 1972 (2nd grade); and the SAT P2 was administered Spring of 1973 (3rd grade).[4]

The FT children (MRT mean score = 44.4) entered the 1st grade at a lower level of readiness than did the NFT children (MRT mean score = 55.0). Analyses of covariance were performed on the subtest scores of the SAT test (grades 1, 2 and 3) with the MRT scores serving as the covariate. Analysis of covariance is a technique which allows for statistical control of group differences (e.g., MRT entry scores) which existed prior to treatment (e.g., FT vs NFT experience). When this statistical technique is applied, any obtained differences between FT and NFT achievement scores can not be attributed to the pre-existing MRT score differences.

At the end of grade 1, there were no differences between FT and NFT subtest scores on the SAT P1, except for the Paragraph Meaning subtest where the mean for the NFT sample (20.8) was significantly higher than that of the FT sample (13.8).

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[4] No biographical data on the sample was available when this report was written.

At the end of grade 2, there were no differences between FT and NFT subtest scores on the SAT P2, except for the Arithmetic Computation subtest on which the FT sample did significantly better (FT mean score = 16.3, NFT mean score = 14.1).

At the exiting grade level (grade 3, Spring) FT and NFT differed significantly only on the Arithmetic Computation subtest with the FT mean score of 29.2 being higher than the NFT mean score of 23.1.

Follow Through intervention did bring the academic performance of the FT children up to the level of the NFT children. Since the FT children had an initial lower level of achievement (MRT entry scores) than did the NFT children, these results can certainly be considered to be in a "positive" direction. At the same time, the results must be regarded cautiously since other group differences (i.e., race, income) were not controlled in this study.

MAP-FT effect on children who have "graduated" from the program.

Cohort I (entered 2nd grades in Fall, 1969). Since the Mathemagenic Activities Program-Follow Through model emphasizes the *process* of learning rather than its content, one expectation is that the effects of MAP intervention will be long-lasting. In other words, since MAP classrooms encourage children to actively explore and manipulate their environments, the children should maintain or improve their relative performance in the fourth grade and beyond.

This hypothesis was confirmed by a preliminary study (Porter & Tomasello, 1974) of a group of 210 children, (FT = 89, NFT = 121), from Gulfport, Mississippi, who entered the MAP program in second grade when MAP was in its first year of operation (1969-70). Seventy two percent of the FT children were from low income families, as opposed to 31% of the NFT children (65% of FT black, 27% NFT black). At the end of the third grade, a NFT control group showed significantly better performance than the FT children on 3 SAT subtests: Word Study Skills, Language, and Arithmetic Computation. By the end of the fourth grade, however, the FT children were performing at the same level as the NFT children on these three subtests, thus showing a marked improvement from the 3rd to the 4th grade. Moreover, a statistical analysis of SAT items (factor analysis) showed that the FT children were applying more general abilities to these problems, while the NFT children were relying more on specific skills.

First grade data, (needed to compare the "starting points" of these children), were not available for this study and, further, the children had not experienced the full benefits of the MAP program. The positive results are therefore especially encouraging. A similar study is now in process, with none of the above limitations, which will be more representative of the effects of the MAP-FT program.

Multiple Outcome Study. What are the effects of MAP-FT intervention on areas other than academic achievement? Data was examined to determine the impact on (1) general intelligence (verbal and nonverbal), (2) operational thinking, and (3) verbal ability (de Lacey & Smock, 1974a). Five hundred thirty eight children from three Southeastern communities (Gulfport, Mississippi was one of the communities) were given (1) the Peabody Picture Vocabulary Test (PPVT) and the Raven's Coloured Progressive Matrices (RPM), (2) the Inhelder and Piaget Matrices (IPM) and the Nixon test (classification), and (3) three subtests from the Illinois Test of Psycholinguistic Abilities (ITPA). The FT and NFT samples consisted of about equal numbers of males and females, low income and non-low income children, black and white children of ages 6, 8 and 10. However, entry ability level and fidelity of implementation of the MAP program were not considered in this study.

The FT program did not arrest the decline in performance that is usual for low income children on the two verbal measures (PPVT and ITPA), but on the nonverbal intelligence tests (RPM, IPM and the Nixon) the FT children either made up for an original deficit or maintained a performance level equal to the NFT children. Even without taking account of the critical factors of entry level and fidelity of implementation, the FT children performed relatively well as compared to NFT children.

Theoretical Studies

Theoretical studies have been designed in conjunction with evaluation studies in order to supplement the knowledge base on which the sponsor constructs classroom environments and evaluates its effects.

de Lacey & Smock (1974b) conducted an investigation, designed to test Berry and Dasen's (1974) "ecological functionalism" hypothesis, which suggests that prediction of differences in patterns of abilities could be made on the basis of a prior analysis of relevant social-cultural variables. The sample consisted of 348 children, 6, 8, and 10 year olds, from two United States and three Australian communities. Gulfport, Mississippi was one of these two United States communities. Two tests of cognitive ability, the Peabody Picture Vocabulary Test (PPVT) (an auditory verbal test) and the Nixon test of reclassification (based on Piaget's theory), were administered to the children. Also, each population of children was assigned an environmental status score based on four variables: income, rural-urban, language, and home style. The performances of FT and NFT children from the Gulfport community were similar on both the PPVT and the Nixon test. In addition, correlation coefficients were calculated between the environmental scores and the performance on each of the tasks, and the correlation coefficients ranged from .45 to .90.[5] The authors concluded that the model proposed by Berry and Dasen (1974b) appears to be appropriate for predicting cognitive skills from extra-school environmental conditions.

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[5] A correlation of .00 would have indicated no relationship between environment and PPVT or Nixon scores; a correlation of 1.00 would have indicated a "perfect" relationship.

The MAP model was designed to influence the cognitive abilities of children from low income families. While this study confirms the prior research indicating that the "environmental status" of children is closely related to intellectual abilities, the MAP classroom learning environment is a "change agent" that can interrupt the connection between conditions outside the classroom and the development of cognitive abilities. That such is the case is illustrated by the results of studies presented earlier in this report.

Conclusions

The results contained in this report provide some encouraging, though tentative, support for the effects of the Gulfport Follow Through Project. On most of the measures FT children did as well as, and in some cases better than the NFT children. Since the FT children typically enter the 1st grade at a lower level of readiness than the NFT children (as measured by MRT scores) it can be assumed that FT intervention has improved the academic and intellectual performance of children in MAP classrooms.

Cognitive gains are predicted to influence achievement scores most noticeably _after_ children have graduated from the MAP classrooms in which mastery of academic content is not a major goal. The achievement gains of fourth grade children previously in the Follow Through Program suggest that this might be the case. Continued examination of these children in subsequent years should add further evidence to evaluate the long-term impact of the MAP-FT Program and the Gulfport Project. Finally, it should be realized that achievement test data represent only a small portion of a child's abilities, and do not reflect all that is learned in the classroom. For this reason, this report, as well as most evaluation reports, should be regarded somewhat cautiously. A total picture of a child would include much more than just a score on an achievement test.

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MAP-FT Project Evaluation Report

Lee County, Virginia[1]

Prepared by B. Fargason Epting[2]

July, 1975

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2 Portions of this report are based on prior work by Anita Bell. Appreciation is expressed to the MAP and the Project Staff (Sam Cecil, Director) and the teachers, and children of the Lee County community.

Foreward

In 1969 the Mathemagenic Activities Program (MAP) was funded as a sponsor in the Follow Through Program (FT), a national experiment to produce educational models designed to enhance the development of young children from low-income families. With the cooperation of the communities it served, MAP-FT began its evaluation program that year. Standardized readiness and achievement tests were administered to FT and non-FT children upon entry in school and at various points during their enrollment. In 1970, "special studies" concerned with underlying theoretical issues were initiated to assess: (1) the patterns of cognitive development of children in MAP projects; and (2) the particular influence of the MAP Classroom Learning Environment on aspects of cognitive development. To date, measures of children's competencies in a variety of areas have been used in addressing such issues as: the impact of kindergarten on children's subsequent performances, the effect of factors beyond direct control of the sponsor (e.g. readiness level, income level), the performance of children after they leave the program, and the impact of the number of years of teacher experience with MAP on achievement. Many of the studies involved are still in process, while others have been completed and published as MAP Reports, Bulletins, and Newsletters. Most of the published studies have focused on research designed to describe MAP effects in general rather than MAP effects in specific communities. Much of that research, however, is of special interest to each project and we hope this report contributes useful information to all those concerned with the education of young children in your community.

C. D. Smock, Director
Mathemagenic Activities Program

Preface

This Project Evaluation Report is a compendium of previously published material, preliminary findings of ongoing research, and data analyzed expressly for the report. It is one of a series of reports designed to yield information which each community can use in assessing the strengths and weaknesses of Follow Through as it is locally implemented. In general, a number of studies suggest that while there are community differences, MAP-FT is achieving its goals. As is indicated in the following text, the conclusion from any research findings depends partially on the objectives of the interpreter. Reports of "high" and "low" scores may be interpreted in a variety of ways. A program which produces high spelling scores may consider itself a failure if, ideally, its teachers should have spent a small amount of time teaching spelling. A program which produces low scores in "cognitive" measures of ability to understand may consider itself a success, if the chief goal is to produce "factual" knowledge rather than to enhance the growth of more general intellectual abilities.

This series of Project Evaluation Reports could not have been generated without the cooperation of each of the local communities involved. The staff of MAP-FT wish to thank the project staffs, teachers, and children who have participated in the collection of data and who have provided many insightful criticisms incorporated in the final drafts.

C. D. Smock, Director

P. Silverman, Evaluation Coordinator

Mathemagenic Activities Program-Follow Through

Project Evaluation Report: Lee County, Virginia

Introduction

This report is a preliminary summary of results of the Mathemagenic Activities Program-Follow Through (MAP-FT) Project in Lee County, Virginia. Not intended in any sense to be a final report, it is designed to summarize results from both completed and ongoing studies. In some cases, there is a lack of matched comparison groups. Where this occurs, interpretations of results are more subject to error. Another limitation is that most of the data are standardized achievement test scores whereas MAP-FT is a process-oriented model which attempts to influence the level and rate of cognitive development as its primary objective. The meaning of achievement test results vis-a-vis MAP program efforts, therefore, needs to be qualified since such achievement scores offer only an indirect measure of the success of the program.

This report is intended for a general audience who may, or may not, be familiar with educational research and evaluation. Therefore, explanatory material has been included in footnotes and parentheses where appropriate.

Community Description

Lee County is a wedge-shaped Virginia county located in the extreme southwest corner of the state between Kentucky and Tennessee. Agriculture, coal, and other mineral resources, cattle and dairy farming are the community's major sources of employment. The county's population, according to the 1970 census is 20,321, approximately 70% of whom live in a non-farming setting and 30% of whom live on farms. The population is almost entirely caucasian. The median number of years of school completed for persons 25 years of age or older is 7.6 years. Fifty-four percent of the males 16 years old and older are employed and over 75% of the males between the ages of 22 and 44 are employed. The median earnings for males 16 years old and older is $4,206. The median income for non-farming families is $3,998 and the median income for farming families is $3,644. Fifty-one percent of the families earn less than $4,000. There are 2,220 families (39.5% of all families) whose mean income is $1,840; of this group 14.3% are receiving public assistance.

There are eight elementary schools in the Lee County area, three high schools, three combined schools (elementary and high school in the same building), and one vocational school. (For a more complete description of Lee County, see Bell, 1973.)

Mathemagenic Activities Program-Follow Through (MAP-FT) identifies children who enter first grade each year by a Cohort number. Thus, children who began first grade in the Fall of 1969 (the first year of MAP in Lee County) are in Cohort I, the children who entered the first grade in the Fall of 1970 are in Cohort II, etc. Identifying children makes it possible to follow the longitudinal development of individual children as well as the MAP program.

MAP Classroom Description

The learning environment of MAP-FT classrooms is designed according to the principle that disequilibrium between different cognitive systems and/or between intrinsic functional structures and experiences of environmental structures is a basic necessity for intellectual development. Thus, sequentially structured sets of curriculum materials and processes are designed so that continual "challenges" to learn are provided. The recommended curriculum process and materials make it possible for the teacher to set up a learning environment consistent with the MAP principles of: (a) mismatch, or appropriate structuring of the child's physical and social environment and learning units that are slightly above his prior conceptual level; (b) self-regulation promoted by "Learning Territories" which encourage instructional strategies that provide for appropriate variation in modes of learning situations and between group and individual learning; (c) coordination activities by which children learn by active manipulation of their physical, social, and symbolic environments. In addition, the "interlocking" nature of the different curriculum contents, (e.g. overlap of Science, Art and Language) creates possibilities for facilitating the development of intellectual processes and skills through a variety of media, activities and social situations. The classroom structure of MAP requires two instructional aides so as to provide for a high level of social interaction in small group instructional task situations.

The Effects of MAP-FT

MAP-FT Effects on Achievement in Grades 1 through 4

Entering first graders in Lee County are given the Metropolitan Readiness Test (MRT) as an index of how prepared or "ready" they are to begin formal schooling. At the end of the first grade they are given the California Achievement Test (CAT), a standardized test which measures how well a child is doing in a number of traditional academic areas. Achievement data on Cohort I children have been analyzed (analysis of covariance) for the time period Fall, 1969 through Spring, 1973, first through fourth grade, taking into consideration the entering MRT levels. By employing this technique, CAT scores were adjusted and statistical differences between FT and NFT found at the end of 1st, 2nd and 3rd grade cannot be attributed to pre-existing MRT score differences. Included in the analysis were 124 Follow Through and 54 non-Follow Through children. Both groups consisted of approximately one half boys and one half girls. Of the FT children, 16.6% were white and 3.4% were black; 83.3% were "low income" and 16.7% were "non-low income". All of the NFT children were both white and from low income families.[1]

Table 1

Mean CAT Raw and Adjusted Subtest Scores for FT and NFT Children (Cohort I)

Spring, 1970 (1st grade) CAT/57 LP

Group	Reading Vocabulary		Reading Comprehension		Arithmetic Reasoning		Arithmetic Fundamentals		Mechanics of English		Spelling		Total Battery	
	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.
FT	48.0	49.2	6.2	6.5	27.9	28.6	31.6	32.5	33.7	34.5	4.8	5.1	152.3	156.4
NFT	49.0	46.5	7.2	6.6	31.4	29.6	34.2	32.1	39.8*	38.0	4.9	4.2	166.5	157.0

Spring, 1971 (2nd grade) CAT/57 UP

Group	Reading Vocabulary		Reading Comprehension		Arithmetic Reasoning		Arithmetic Fundamentals		Mechanics of English		Spelling		Total Battery	
	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.
FT	26.1	26.7	24.2	25.0	16.9*	17.4	93.4	95.2	29.6	30.4	9.7	10.0	199.9	204.7
NFT	26.3	25.1	26.1	24.2	15.8*	14.6	97.9	93.8	31.7	29.7	9.4	8.8	207.1	196.1

Spring, 1972 (3rd grade) CAT/70 L2

Group	Reading Vocabulary		Reading Comprehension		Mathematics Computation		Mathematics Concepts & Problems		Language Mechanics		Language Usage & Structure		Language Spelling		Total Battery	
	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.
FT	27.9	28.4	26.9	27.3	56.8	57.5	31.1	31.7	26.1*	27.1	13.2	13.4	14.2	14.6	194.3	198.6
NFT	27.3	26.1	25.4	23.8	55.0	53.4	30.6	29.2	24.3	22.0	13.8	13.1	13.5	12.8	189.9	180.0

*statistically different at the .05 level

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[1] For an index of "Low-Income" the reader is referred to Department of Health, Education, and Welfare, Office of Education-Follow Through Program, Washington, D. C. Federal Register 1974, No. 121, Part II.

Analysis of the achievement scores for both groups at the end of the first grade shows that the FT children scored only slightly lower than their NFT counterparts on all six CAT subtests but significantly lower on only the Mechanics of English (Table 1)[2]. By the end of the second grade, the FT children scored lower on only four of the subtests, slightly higher on one subtest, Spelling, and significantly higher on another subtest, Arithmetic Reasoning. By the end of the third grade the FT children had somewhat higher scores on Language Mechanics. The data obtained from the fourth grade (not tabulated) include 98% of the 124 Cohort I FT children, and 197 additional NFT children (total=251). The sample, then, is not identical to that reported in the Cohort I comparisons for grades 1 through 3. For these reasons the results of the fourth grade data could not be directly compared with the first through third grade data. Although the fourth grade NFT group scored higher than the FT group on all subtests except Lanugage Usage and Structure, none of the differences were statistically significant.

The achievement data for Cohort III children, who entered the first grade in the Fall of 1971 - two years after Cohort I, have been analyzed for the time period Fall 71 through Spring 74 (first grade through third grade). Although the biographical data were unavailable for most of the Cohort III children, it is assumed that the ratios of boys/girls, low income/non-low income, and black/white are fairly comparable to the Cohort I children. The significant finding for Cohort III is that FT children begin first grade "less prepared" for school, as measured by the MRT scores (Table 2) than the NFT counterparts, but at the end of third grade they are doing significantly better than the NFT children on seven CAT subtest and on the total CAT battery score (Table 2).

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[2] Differences between means are judged to be "statistically significant" when those differences can be expected to occur by chance only 5 times out of 100.

Table 2

Mean MRT and CAT Subtest Scores for FT and NFT Children (Cohort III)

Fall, 1971 (1st Grade) MRT

Group	Word Meaning	Listening	Matching	Alphabet	Numbers	Copying	Total
FT	8.2	10.8	7.5	9.6	12.8	7.8	56.6
NFT	9.0	11.4	7.7	9.6	13.7	7.7	59.0

Spring, 1974 (3rd grade) CAT/70 L2

Group	Read Vocab	Read Comp	Read Total	Math Comp	Math Conc Prob	Math Total	Lang Mech	Lang Usage Struct	Lang Total	Spell	Total Battery
FT	33.1	31.0*	63.9*	64.8*	35.7	100.4*	35.1*	15.2	50.3*	16.8*	231.9*
NFT	30.7	25.4	56.0	58.0	33.3	91.2	26.7	13.9	40.9	14.6	202.5

*statistically different at the .05 level

The differences in performance between Cohort I and Cohort III are probably attributable to "program maturity". A program is said to mature as a function of (1) the teacher's experience with implementing the MAP principles and (2) the number of years the program has been in the community. Consequently, it was expected that Cohort III would do better than Cohort I since Cohort III should have benefited by the two years of program development between 1969-1971. That program maturity had such a marked effect on standardized achievement test performance was somewhat unexpected since the MAP-FT model is process-oriented. That is, the program aims primarily to influence general cognitive development not specific academic skills per se.

The Effect of Program Maturity on Achievement

In an effort to substantiate the implicit effects of program maturity as revealed by the Cohort I and III data reported above, an analysis of variance was performed on data collected from some of the teachers and students in Lee County over a four year period (1969-1973). A program reaches maturity when it has produced its full effects, has reached a stabilized level and when the continuation of the program does not increase its effects. One way of measuring program maturity is in terms of teacher maturity; i.e., by the number of years she (or he) has implemented the MAP classroom program. Students' performance at the end of each year is used as one reflection of the teacher's skills in program implementation (Continuation Proposal, 1975).

In the spring of 1970 and 1971 the CAT/57 was administered in grade 1 and scores on the following subtests were used for this analysis: (1) Reading Vocabulary, (2) Reading Comprehension, (3) Arithmetic Reasoning and (4) Spelling. In the spring of 1972 and 1973 CAT/70 was administered. Subtests comparable to the earlier form were determined to be (1') Reading Vocabulary, (2') mean of Reading Comprehension and Language Auditing, (3') Mathematics Concepts and Problems, and (4') Language Spelling.

The analysis of the data indicate that, indeed, the number of years of MAP-FT experience of the teacher had a significant positive effect on the academic performance of the students; the more "mature" the teacher, the better the performance of her children. In addition to these results, it was found that the first three subtests: Reading Vocabulary, Reading Comprehension, and Arithmetic Reasoning contributed most to the difference whereas Spelling contributed very little. Further, increases in scores on the first three subtests were made each year period spelling scores increased only for years one and two and then leveled off (Huberty and Smock, 1974.)

These results tend to confirm MAP predictions but the analyses are not altogether satisfactory. First, the entering first grade abilities of the children in this particular study were not taken into consideration prior to the analysis. Second, it is possible that the leveling-off after three years may be followed by another period of increasing effectiveness at a later time - conceptionally comparable to the second growth "spurt" often seen in children during adolescence.

MAP-FT Process Effects on the Development of Social Relations

Piagetian theory implies that cooperative activity provides an opportunity for contradiction (i.e., different interpretations of events) to occur and that the resolution of these contradictions facilitates the development of logical thought. Piaget goes on to say that the child's understanding of social relations and of logical relations are parallel developments. One way to measure a child's understanding of social relations is to determine his role-taking skill. For example, can the child separate his understanding of a cartoon sequence from that of another individual's understanding who has seen only part of the sequence? That is, can he coordinate two possible view points? The understanding of logical relations can be determined through the child's classification skill [see MAP-FT Effects on Cognitive Competence, p.8]. Classification refers to the child's ability to construct and/or reconstruct groupings of objects according to the similarity based on differing qualities. For example, in an array of green circles and red circles and red squares, the latter two can belong to the group "all red objects", but the same red circles would be in a group with green circles if the relevant quality was "all circles". As in role-taking, successful completion of this task requires that the child coordinate two points of view; i.e., that he decenters.

A study to determine if these two aspects of development (i.e., social and cognitive) are equally affected by the MAP-FT curriculum was recently completed in Lee County (Gash and Smock, 1975). Follow Through and Non-Follow Through children in grades 1, 2, and 3, and a small group of kindergarten children participated in the study. The results show that MAP-FT children in grades 1, 2, and 3 tended to be superior to their Non-Follow Through counterparts with respect to classification ability. Also, the MAP-FT girls were significantly superior to the NFT girls on the several measures of social role-taking. Children in the first and second grades who scored high on the classification measure typically scored high on the role-taking task, too. This relationship was not found, however, in kindergarten or third grade. The lack of the relationship between these aspects of development in kindergarten may be a function of the large number of children who were egocentric (i.e., could only consider one point of view) on both tasks. If this is so, an examination of this relation using a larger sample may demonstrate a significant association. For the third graders, it may be that the cartoons take on different meanings, but only a more refined follow-up study can confirm or dispel that speculation.

MAP-FT Effects on Cognitive Competence

In the winter of the 1971-72 school year, Dr. Nikki Mohseni, a MAP-FT research associate from the University of Tehran, Iran, collected data in Lee County on Follow Through and Non-Follow Through children 7, 8 and 9 years old. According to the MAP program, problem solving and logical reasoning ability (i.e., cognitive competence) of children in MAP classrooms should be accelerated. The purpose of the Mohseni study was to determine if MAP was having such an impact.

Several tasks were administered to measure:

1. Conservation; that is, understanding that, even though an object can be made to look different (for example, when a ball of clay is flattened), certain quantities of the object remain constant (such as amount of weight).

2. Seriation; that is, the ability to arrange objects in decreasing and increasing order (for example, by height) and the ability to make judgements about relationships without having to compare directly (if object A is taller than object B, and object B is taller than object C, then object A is taller than object C).

3. Classification; that is, understanding that different objects can be grouped together by one characteristic but could be grouped differently by another characteristic. For example, a blue ball point pen and a black felt tip pen both belong to the group "pen" but simultaneously one belongs to the subgroup of pens with blue ink, and the other belongs to the subgroup with black ink.

The MAP-FT theory of child development (i.e., Piagetian) contends that a child's ability on these three tasks (classification, seriation, and conservation) reflects the development of logical reasoning capabilities. As can be seen in Table 3, 7 year-old Follow Through children (Cohort III) did better than the NFT counterpart on five tasks; did equally well on four tasks; and did more poorly on three tasks.

Table 3

Mean Score on each cognitive task for 7, 8, and 9 year olds

Follow Through and Non Follow Through

Lee County, Virginia[†]

Task	Age 7 FT	Age 7 NFT	Age 8 FT	Age 8 NFT	Age 9 FT	Age 9 NFT
Conservation of Discont. Quant.	1.25*	.916	1.75*	1.25	1.67	2.00
Conservation of Cont. Quant.	1.00	1.00	1.50*	1.08	1.58	1.67
Conservation of Weight	.25	.42*	1.00*	.75	1.08	1.00
Conservation of Volume	.00	.00	.25*	.17	.17	.33*
Seriation 1	1.25	1.25	1.67*	1.08	1.75	1.83*
Seriation 2	1.17	1.17	1.50*	.67	1.67	1.83*
Seriation 3	1.25*	.83	1.50*	.33	1.67	1.67
Transitivity of Length	.75	.83*	1.50*	1.00	1.00	1.83*
Double Seriation	1.00*	.83	1.42*	1.00	1.42	1.67*
Transivity of Weight	.00	.25	1.00*	.50	1.00*	.83
Classification 1	.25*	.17	.42*	.08	.67	1.17*
Classification 2	.33	.17	.67*	.50	.83	1.00

*Higher Score. A score of 2 was the highest possible in all cases.

[t] Adapted from Mohseni and Smock, 1974.

The 8-year-old FT children (Grade 2, Cohort II) did consistently better than their NFT counterparts on all twelve tasks. The 9-year-old FT children (Grade 3, Cohort I) did equal to or better than their NFT counterparts on only three tasks. Since the majority of the 8-year-old FT children had been in the MAP program for two years and were being taught at that time by teachers with two years of FT experience, their group may have been benefiting from FT program maturity effects. Although the 9-year-old FT children had also had at least two years of MAP experience, their teachers, for each year had only one year of experience with the MAP curriculum process. As indicated earlier (pp. 5-6) increased teacher maturity results in increased achievement scores. This may also be the case for cognitive competence scores.

It will be interesting to test 7 and 9-year-olds at a later date to determine if indeed, given comparable exposure to the mature FT teacher, they, too, will consistently out-perform their NFT counterparts, as the 8-year-olds did in this study. Further elaboration of the results of this study can be found in the MAP-FT publications "Growth of Logical Thought in Rural and Urban Environments" (Ebert and Smock, 1973) and "Development of Concrete Operations in Urban and Rural Communities: A Study of the Effect of the Mathemagenic Activities Program" (Mohseni and Smock, 1973).

Conclusions

The results summarized in this report provide some encouraging, although tentative, support for the effects of the Lee County MAP-FT project. On measures of cognitive ability, FT children typically did better than NFT children although qualification of some of the results was necessary. With respect to achievement results, FT children typically enter the first grade at a lower level of readiness than NFT children but show improved academic performance by the end of the third grade. For children who have experienced a more "mature" program this effect is even more dramatic.

While it is hoped that FT achievement scores will not fall below those of NFT counterparts, any achievement gains of FT children while they are in the program might be construed as indicative of gains in cognitive abilities. Cognitive gains are predicted to influence achievement scores more noticeably after children have graduated from the MAP classrooms and are experiencing classrooms in which mastery of academic content is a major goal. The achievement gains of fourth grade children previously in the FT program suggest that this is, in fact, the case. Continued examination of these children in subsequent years should provide further evidence with which to evaluate the long-term impact of the MAP-FT program.

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MAP-FT Project Evaluation Report

Pickens County, Georgia[1]

Prepared by Adie Lin[2]

November 1975

Mathemagenic Activities Program
University of Georgia Follow Through
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[2] Portions of this report are based on prior work by Michael Holland. Appreciation is expressed to the MAP staff, Project staff (Linda Pruitt, Director), and teachers and children of the Pickens community.

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Forward

In 1969 the Mathemagenic Activities Program (MAP) was funded as a sponsor in the Follow Through Program (FT), a national experiment to produce educational models designed to enhance the development of young children from low-income families. With the cooperation of the communities it served, MAP-FT began its evaluation program that year. Standardized readiness and achievement tests were administered to FT and non-FT children upon entry in school and at various points during their enrollment. In 1970, "special studies" concerned with underlying theoretical issues were initiated to assess: (1) the patterns of cognitive development of children in MAP projects; and (2) the particular influence of the MAP Classroom Learning Environment on aspects of cognitive development. To date, measures of children's competencies in a variety of areas have been used in addressing issues such as: the impact of kindergarten on children's subsequent performances, the effect of factors beyond direct control of the sponsor (e.g. readiness level, income level), the performance of children after they leave the program, and the impact of the number of years of teacher experience with MAP on achievement. Many of the studies involved are still in process, while others have been completed and published as MAP Reports, Bulletins, and Newsletters. Most of the published studies have focused on research designed to describe MAP effects in general rather than MAP effects in specific communities. Much of that research, however, _is_ of special interest to each project and we hope this report contributes useful information to all those concerned with the education of young children in your community.

C. D. Smock, Director
Mathemagenic Activities Program

Preface

This Project Evaluation Report is a compendium of previously published material, preliminary findings of ongoing research, and data analyzed expressly for the report. It is one of a series of reports designed to yield information which each community can use in assessing the strengths and weaknesses of Follow Through as it is locally implemented. In general, a number of studies suggest that while there are community differences, MAP-FT is achieving its goals. As is indicated in the following text, the conclusion from any research findings depends partially on the objectives of the interpreter. In concluding that the program is "good" because it is meeting its goals, the staff of MAP-FT do not wish to imply that other educational methods are "bad". The other methods may simply be influencing children in beneficial ways not measured by MAP. Similarly, reports of "high" and "low" scores may be interpreted in a variety of ways. A program which produces high spelling scores may have failed to implement its goals if, ideally, its teachers should have spent a small amount of time teaching spelling. A program which produces low scores in "cognitive" measures of ability to understand may consider itself a success, if the chief goal is to produce "factual" knowledge and the program philosophy does not provide definition of growth of more general intellectual abilities.

This series of Project Evaluation Reports could not have been generated without the cooperation of each of the local communities involved. The staff of MAP-FT wish to thank the project staffs, teachers, and children who have participated in the collection of data and who have provided many insightful criticisms incorporated in the final drafts.

C. D. Smock, Director

P. Silverman, Evaluation Coordinator

Abstract

The present report provides an overview of the impact of the Mathemagenic Activities Program-Follow Through (MAP-FT) on the academic achievement and cognitive development of children from grade one through grade three in Pickens County, Georgia, 1969 to 1974. Several instruments have been employed. Each fall, the entering first graders received the Metropolitan Readiness Test (MRT). Each subsequent spring and fall, through the third grade, children were given appropriate forms of the Stanford Achievement Test (SAT). In addition, a wide range of tests was given by Stanford Research Institute (SRI) to various grades from 1969 through 1974 to serve the purpose of a National Follow Through Evaluation. Cognitive development was evaluated using five cognitive measures employed by de Lacey and Smock (1974a), who examined first through fourth grade children. Data describing activities in the classroom have also been collected by SRI in spring 1972, using the Classroom Observation Instrument (COI). Findings from studies using the achievement data indicated that: (a) teachers who had two years of FT experience were more effective in increasing students' academic performance than were teachers who had either one year of experience, or no experience in the FT program; (b) the longer a grade level has been associated with FT, the better the academic performances of the children; and (c) there was a tendency for increases in FT achievement scores, relative to Non-Follow Through (NFT) scores, as children progressed through the FT Program. Test data from SRI indicated that the overall performances of children in Pickens were higher than National Follow Through means and were comparable to National Non-Follow Through means. Data from cognitive measures generally indicate a favorable impact of the FT program. Classroom observations showed that children in FT classrooms participated more actively than those in NFT classrooms.

Mathemagenic Activities Program-Follow Through Project Evaluation Report: Pickens County, Georgia

This report is a preliminary summary of results of the Mathemagenic Activities Program-Follow Through (MAP-FT) Project in Pickens County, Georgia. This is not intended in any sense to be a final report, but is designed to summarize results from studies which are completed and from ongoing and uncompleted studies where data are available. In some cases, there is a lack of matched comparison groups (i.e., Non-Follow Through students). Where this occurs, the results can not be used to judge the absolute "success" or "failure" of Follow Through. Another limitation is that most of the data are based on standardized achievement tests. MAP-FT is a process-oriented model which attempts to influence the level and rate of cognitive development as its primary objective. The interpretation of achievement test results, therefore, needs to be qualified since achievement test scores offer only an indirect measure of the success of the program.

This report is intended for a general audience who may, or may not, be familiar with educational research and evaluation. Explanatory material has been included in footnotes and parentheses where appropriate.

Community Description

Pickens County, in central North Georgia, was created in 1853 and spans 225 square miles, including Mount Oglethorpe which begins the 2,000 mile Appalachian Trail to Maine. The chief products of this county are marble, light-industry products, and poultry.

The 1970 census shows the county population to be 9,620 residents. 3.5% of which are non-white. Population statistics further indicate that 8,624 are rural nonfarm residents, with 993 rural farm residents. Per capita income in 1970 was $2,474, some $850 below the average Georgia per capita income of $3,332 for that year. Median income figures show that of the 2,525 families, most were earning around $7,300 per annum, with 7.4% earning more than $15,000 and 45% indexed at or below poverty level. The population has remained fairly stable for the last 30 years: 9,100 in 1940; 9,800 in 1965; 9,600 in 1970.

MAP Classroom Description

The learning environment of Mathemagenic Activities Program-Follow Through (MAP-FT) classrooms is designed according to the principle that disequilibrium between different cognitive systems and/or between intrinsic functional structures is a basic necessity for intellectual development. Thus, sequentially structured sets of curriculum materials and processes are designed so that continual "challenges" to learn are provided. The recommended curriculum materials make it possible for the teacher to set up a learning environment consistent with the MAP principles of: (a) mismatch, or appropriate structuring of the child's physical and social environment and learning units that are slightly above his prior conceptual level; (b) self-regulation promoted by "learning territories" which encourage instructional strategies that provide for appropriate variation in modes of learning as well as balance between highly structured and relatively low structured learning situations and between group and individual learning activities; and (c) coordinated activities by which children learn by active manipulation of their physical, social, and symbolic environments. In addition, the "interlocking" nature of the different curriculum contents (e.g., overlap of Science, Art, and Language) creates possibilities for development of intellectual processes and skills through a variety of media, activities and social situations. In its classroom structure, MAP requires two instructional aides, in order to provide a high level of social interaction in small group instructional task situations.

Entering Characteristics of FT and NFT Children

MAP-FT children differ from their NFT (Non-Follow Through) counterparts on three dimensions for which records were available: preschool experience, level of income,[1] and academic readiness.

Preschool experience. Two types of preschool academic experience occur: Headstart and Title I. A greater proportion of children enter FT first grade classrooms with some form of preschool experience than do the children who enter NFT first grade classrooms. Table 1 presents the percents of 1969-70 and 1970-71 FT and NFT first grade children with preschool experience.

Table 1

Preschool Experience of FT and NFT Children Entering First Grade

Preschool Experience	1969-70		1970-71	
	FT	NFT	FT	NFT
Head Start	44.8%	0.0%	46.5%	8.2%
Title I	12.0%	35.3%	18.1%	28.6%
None	33.6%	58.8%	33.9%	32.65%
Unknown	9.6%	5.9%	1.6%	30.6%

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[1] For index of "Low-income", the reader may refer to Department of Health, Education, and Welfare, Office of Education: Follow-Through Program, Washington, D. C. Federal Register. 1974, Vol. 39, No. 121, Part II.

Level of income. FT classrooms typically contain more children from low income families than comparable NFT classrooms. Table 2 presents the percents of low and non-low income families for FT and NFT first grade children in 1969-70 and 1970-71.

Table 2

Family Income Level of FT and NFT Children Entering First Grade

Income Level	1969-70		1970-71	
	FT	NFT	FT	NFT
Low Income	78.4%	0.0%	86.6%	6.00%
Non-Low Income	20.0%	94.1%	13.4%	94.00%
Unranked	1.6%	5.9%	0.0%	0.00%

Academic readiness. Academic readiness, as measured by the Metropolitan Readiness Test (MRT), refers to how well prepared a child is for the academic material in grade 1. This measure varies with level of income as well as with preschool experience (Ebert, 1973). In all years except 1969-70, NFT children scored higher than FT children on the MRT (Table 3).

Table 3

Comparison of FT and NFT Entering Children in Academic Readiness Measured by MRT (mean total scores)

Program	1969-70	1970-71	1971-72	1972-73	1973-74
FT	58.4	48.1	48.2	52.3	57.2
NFT	53.1	50.7	61.3	60.7	66.1

Data Collection

The data to be discussed in this report can be classified as (a) achievement measures, (b) cognitive competence measures, and (c) classroom observation measures.

Achievement measures. The entering first graders received the MRT in the fall. Each subsequent spring and fall, through the third grade, children were given appropriate forms of the Stanford Achievement Test (SAT): Spring, Grade 1, SAT P1; fall, Grade 2, SAT-P1; spring, Grade 2, SAT-P2; fall, Grade 3, SAT-P2; spring, Grade 3, SAT-P2. Data from these achievement measures were available for both FT and NFT children from 1969 to 1974, except for the following cases: For the FT sample, fall 1972, Grade 2; spring 1973, Grade 2; fall 1969, Grade 3, and spring 1970, Grade 3. For NFT sample, fall 1969, Grade 1; spring 1973, Grade 1; spring 1973, Grade 2; and fall 1970, Grade 3. In addition, a wide range of project feedback data was collected in a National Follow Through Evaluation provided by SRI (Stanford Research Institute) from 1969 through 1974. This report incorporated results of Metropolitan Achievement Tests (MAT) administered to Pickens MAP-FT, National Follow Through, and National non-Follow Through samples: Spring 1972, Grade I, MAT-PI; spring 1973, Grade 2, MAT-PII; spring 1974, Grade 3, MAT-Elementary.

Cognitive competence measures. In winter 1972, 538 children from three Southeastern communities (Pickens, Georgia was one of the communities) were given five cognitive tests (de Lacey and Smock, 1974a). The children included kindergarten, first, second, third, fourth and fifth graders, 269 from FT and 269 from NFT. The five tests were Peabody Picture Vocabulary Test (PPVT, a verbal test of intelligence), Raven's Progressive Matrices (RPM, a non-verbal test of intelligence), Illinois Test of Psycholinguistic Abilities (ITPA, a test for identifying specific language and conceptual defects), Inhelder and Piaget Matrices Test (IPM, a test of classification abilities), and Nixon Test of Reclassification (a test of the ability to switch from classifying certain elements according to one criterion (e.g., color) to classifying the same elements according to another criterion (e.g., shape).

Classroom observation measures. In spring, 1972, social and physical aspects of four FT and two NFT classrooms at each of first through third grades were observed by trained SRI coders using the SRI Classroom Observation Instrument (COI).

The Effects of MAP-FT

MAP-FT effects on academic performance

Does MAP-FT bring about changes in academic performance as reflected by achievement measures? As described in the last section, the first, second, and third graders were administered achievement tests in the fall when they entered each grade, and in the following spring prior to entering each grade. This data collection design allowed for assessment of academic growth as it developed during the course of the school year, as well as changes from one school year to the next.

Three major subquestions have been addressed regarding the impact of MAP-FT on children:

(a) Are there differences in the performance of children whose teachers have been in FT for different lengths of time?

(b) Are there differences in the performance of children whose grade levels have been associated with FT for different lengths of time?

(c) Are there differences in the performance of children who have been in FT for different lengths of time?

Teacher experience. Are there differences in the performances of children whose teachers have been in FT for different lengths of time?

Data were used from six first grade classrooms to answer this question. Two classrooms had teachers with two years of FT experience, two had teachers with one year of FT experience, and two had teachers with no FT experience. In the fall of 1970 the MRT was administered to 20 students in each of these six classrooms. In the spring of 1971 the SAT-P1 was administered to each of these students. The influence of the teachers' experience on childrens' performances was assessed by noting the number of children with changes in scores between the two test dates and the direction of changes. Each set of scores was converted to 'stanine scores'.[4] Table 4 provides the results.

Table 4

Stanine Score Changes From Fall MRT to Spring SAT-PI at Three Levels of Teacher FT Experience

Teacher Years of FT Experience	Mean Stanine		Number of Students Changing Scores from Fall Test to Spring Test	
	Fall (MRT)	Spring (SAT-P1)	Gain	Loss
0(NFT)	4.50	4.08	21	21
1	4.48	4.03	17	19
2	4.53	5.73	27	6

As can be seen from the table, teachers who had two years of FT experience were more effective in increasing first grade performance than teachers who had either one year of FT experience or no FT experience, at least for 1970-71.

Grade-level maturity. Are there differences in the performances of children whose grade levels have been associated with FT for different lengths of time?

Only the length of time that a grade level has been in operation within MAP-FT, regardless of teacher experience, was taken into account. The SAT-P1 spring scores of FT and NFT children in first grade classrooms of Cohorts I,

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[4] Stanine scores are transformed scores using national norms and converted by standardization procedure. The latter is a statistical procedure, which, given one assumption, allows tests employing different scales to be converted into the same scale for comparison. That assumption is that the MRT and SAT-PI Stanine conversions are based on the test scores of comparable national normative groups. The assumption must also be applied in Tables 6, 7 and 8.

II, III, IV, and V[5] were compared and Table 5 presents these results.

Table 5

Mean Total Scores on SAT-P1 in First Grade for Cohort I, II, III, IV and V

Program	Cohort I 1970	Cohort II 1971	Cohort III 1972	Cohort IV 1973	Cohort V 1974
FT	122.09	136.70	147.45	150.95	124.33
NFT	142.87	123.37	152.65	(not available)	133.32

There was a steady improvement in scores from 1970, when FT had been in operation in grade 1 for one year, through 1973, when FT had been in operation for four years. Though NFT data are missing for 1973, the improvement from 1970 to 1973 was greater for FT than for NFT classrooms. The drop in performances in 1974 is probably due to events peculiar to that year since there was a corresponding drop in SAT-P1 scores in the NFT classrooms during the same year. The project staff reports two unusual events that might have influenced the scores: (1) tornados swept through the county in early April, 1974, three days after testing was begun. Warnings or storms preceding them might have reduced the validity of the tests. (2) A large number of grade 1 teachers in the 1973-74 school year were first-year teachers. Of the five grade 1 FT teachers, 3 were new. Of the four grade 1 NFT teachers, 1 was new. Teacher turnover might have acted to reduce the fidelity of implementation of the model and, accordingly, reduced indices reflecting implementation. In general, these results indicate that the longer a particular grade level has been associated with FT, the better the academic performances of the grade 1 children.

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[5] Cohort I refers to those children who entered FT program in Fall 1969 as first graders, when the program was in its first year of operation in Pickens County. These children exited from FT in 1972, after they had been in FT for 3 years. Cohort II children entered FT program in Fall 1970 as first graders, when the program was in its second year of operation in Pickens County. These children exited from FT in 1973, after they had been in FT for 3 years, etc.

When the improvement from fall test (MRT) to spring test (SAT-P1) within the same academic year was calculated for FT grade one classrooms for Cohort I, II, III, IV, and V, and compared to the improvement made by corresponding NFT classrooms during the same period of time, results indicated that, except for Cohort I (1969-70), children in FT classrooms showed greater improvements than did those in NFT classrooms (Table 6).

Table 6

Mean Gains in Stanine Scores from Fall Test to Spring Test for FT and NFT First Graders at Each Academic Year

Program	1969-70	1970-71	1971-72	1972-73	1973-74
FT	1.30	3.19	3.72	3.56	1.56
NFT	3.07	2.22	2.74	(not available)	1.21

Child experience. Are there differences in the performance of children who have been in FT for different lengths of time?

To answer this question, the changes in achievement scores from grade one through grade three for Cohort I and I FT children were compared to the corresponding changes in a NFT group. All scores were converted to stanine scores, using national norms, in order to compare performances on different achievement tests. The results are shown in Table 7.

Table 7

Mean Stanine Scores for Cohort I and Cohort II FT Children and Corresponding NFT Children on Stanford Achievement Test From Grade 1 to Grade 3

Cohort	Program	Grade 1	Grade 2	Grade 3
I	FT	7.27	4.50	3.55
	NFT	8.17	4.44	4.31
II	FT	9.00	4.69	3.64
	NFT	8.50	4.31	2.67

For Cohort I, NFT classrooms scored higher than FT classrooms, and the difference remains roughly the same at grade one when the FT children enter the program and at grade three when the FT children exit from the program. For Cohort II, however, FT children had higher stanine scores than their FT counterparts, and the difference increased steadily, though slightly, from grade one to grade three.

MAT achievement data collected by SRI from Cohort III Pickens children (grade 1 through 3) in spring of 1972, 1973, and 1974, also presented as stanine scores, show that the performances of MAP-FT children were higher than the mean performances of an overall Follow Through National group and comparable to the mean performance of a Non-Follow Through National group. As can be seen from Table 8, there was a comparable amount of change in stanine scores from 1st grade through 3rd grade for FT children and National Non-Follow Through children.

Table 8

Normative Stanine Scores of Mean Performance of Cohort III MAP FT Children on MAT compared to Follow Through National (Fn) and Non-Follow Through National (NFn)

Test Point	Word Knowledge			Word Analysis			Reading			Total Reading			Total Math		
	MAP	Fn	NFn	MAP	Fn	NFn	MAP	Fn	NFn	MAP	Fn	NFn	FT	Fn	NFn
1st Grade Spr 1972 (MAP-P1)	4.81	4.06	4.56	5.00	4.31	4.69	5.63	4.69	5.42	5.11	4.19	5.00	4.56	3.82	4.06
2nd Grade Spr 1973 (MAT-PII)	4.94	4.19	4.56	4.94	4.31	4.56	5.00	4.56	4.56	4.94	4.31	4.94	4.94	4.69	4.31
3rd Grade Spr 1974 (MAT-Elementary)	4.81	4.19	4.81	(not applicable)			4.69	4.19	4.69	4.69	4.31	4.69	4.94	4.00	4.31

Summarizing, data for Cohorts I and II, (Table 7) for Cohort I there was no indication that FT children improved achievement level more rapidly in successive grade levels than the corresponding NFT children. For Cohort II, however, there seems to be a positive effect as a result of the FT program; the longer the children have been in the FT program the greater their improvement in achievement performances compared to the NFT counterparts. These results are especially encouraging since NFT children sampled in the MAP evaluation are, for the most part, from non-low income families.

While SRI results for Cohort III (Table 8) cannot be directly compared to MAP-FT results (different achievement tests and comparison groups were used), they show consistent trends. MAP-FT children attain scores equal to or greater than a national non-FT sample. In addition, they score higher than a national FT sample.

MAP-FT effects on cognitive growth

As indicated in the introduction, achievement scores can only provide an indirect measure of the success of this program. Cognitive measures of development should give a more relevant picture of program impact. What, then, are the effects of MAP-FT intervention on areas other than academic achievement? Data were examined (deLacey & Smock, 1974a) to determine the impact of FT on (1) general intelligence (verbal and nonverbal), (2) operational thinking, and (3) verbal ability. Five hundred thirty eight children from three Southeastern communities (Pickens was one of the communities) were given (1) the Peabody Picture Vocabulary Test (PPVT) and the Raven's Coloured Progressive Matrices (RPM), (2) the Inhelder and Piaget Matrices (IPM) and the Nixon Test (classification), and (3) three subtests from the Illinois Test of Psycholinguistic Abilities (ITPA). The FT and NFT samples consisted of about equal numbers of male and female, low income and non-low income, and black and white children of ages 6, 8 and 10. Entry ability level and fidelity of implementation of the MAP program were not considered in this study.

Results of these cognitive measures are shown in Table 9. The FT program did not arrest the decline in performance that is usual for low income children on the verbal intelligence and verbal ability measures (PPVT, ITPA), but on both the non-verbal tests of general intelligence and operational thinking (RPM, IPM and the Nixon) the FT children either made up for an original deficit or maintained a performance level equal to the NFT children. Even without taking account of the critical factors of entry level and fidelity of implementation, the FT children performed relatively well as compared to NFT children.

Table 9

Mean Scores of Some Cognitive Measures (de Lacey & Smock) for FT and NFT Children

Program	Age	PPVT	RPM	IPM	Nixon	ITPA 1,2
FT	6	87.43	13.44	---	3.12	97.67
	8	88.72	18.94	3.47	4.23	86.24
	10	83.60	24.30	4.94	5.40	80.67
NFT	6	90.89	15.06	---	2.60	96.70
	8	93.29	19.81	3.77	4.52	92.58
	10	90.71	24.86	4.99	4.91	84.44

1 Scaled Scores.
2 ITPA scores in the present table represent the total scores of the following three subtests: Auditory Association, Verbal Expression, and Grammatic Closure.

Fidelity of Implementation of MAP-FT

As part of an evaluation of the National Follow Through Program, Stanford Research Institute collected classroom observation data during spring 1972 in Pickens County. Four FT and two NFT classrooms at each grade level (1, 2, 3) were observed. Both children and adults were the focus of observation for estimating frequency of selected physical arrangements and social-instructional activities of the classroom. All interpersonal interactions were recorded in the form "Who does what to whom and how."

Comparisons of FT classrooms with NFT classrooms were on 23 measures from the Observation Summary Form (OSF) of Classroom Physical Characteristics, on 55 measures of the Classroom Check List (CCL) of classroom activities, and on 120 measures based on Five-Minute Observation (FMO) of interpersonal interaction (e.g., between teacher and child).

On the adult-focused observations, significant differences were found on 42 of the 55 CCL variables and 28 of the 120 FMO variables. On the child-focused observations, 30 out of 120 FMO variables were found to be significantly different. Compared to NFT classrooms, FT classrooms exhibited a higher ratio of adults to children and a greater number of activities occurring at the same time. Compared to NFT children, FT children initiated more communication, responded more to divergent questions, and received more praise and less negative corrective feedback. On the whole, child participation in the classroom was greater in the FT setting than in the NFT setting. These differences between classroom activities of FT and NFT suggest a good fidelity of implementation of the MAP-FT program. Limitations of the instrument (which was designed to assess the classroom atmospheres of many sponsors and thus does not describe any one completely commensurate with sponsor goals) precludes a definitive statement. The sponsor is presently constructing new variables to more adequately use the instrument.

Conclusions

The results contained in this report provide some encouraging support for the effects of the Pickens MAP Follow Through Project. The impact of MAP-FT on children's intellectual improvement has been examined by various achievement tests, cognitive measures and classroom observation data. On the whole, FT children did better than the NFT children on many measures. Since the FT children typically enter the 1st grade at a lower level of readiness than the NFT children (as measured by MRT scores) it can be concluded that FT intervention has improved the academic and cognitive abilities of children in MAP classrooms.

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Cumulative Deficit Phenomenon: A Perspective for MAP-Follow Through Evaluation

by

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Introduction

The cumulative deficit hypothesis was first proposed by Martin Deutsch and associates of the Institute for Developmental Studies (Deutsch, 1965). They found that socio-economic differences in many achievement variables became more marked as the child progressed from the first through the fifth grade years. Cooper described this same phenomenon in a large study involving more than 30,000 black pupils in Georgia (Cooper, 1964). She found a greater lag between reading achievement and expected achievement with each succeeding grade level. More recently, Stickney has reported evidence that the mean achievement growth rate in reading and mathematics of children from low-income families was only about 66% of the growth rate of children from middle class families (Stickney, 1977). He observed that the fading of initial gains sometimes occurred even while children were participating in model compensatory education programs. The purpose of this report is to examine MAP-Follow Through evaluation data to determine the extent to which the cumulative deficit phenomenon occurs in children participating in our model early childhood program.

Description of the Program

The Mathemagenic Activities Program-Follow Through (Smock, 1969, 1978) is a comprehensive education program for children (K-3) from low-income families. Originally formulated at the University of Georgia this program has been implemented in several communities (Lee County, Virginia; Pickens County, Georgia; McCormick County, South Carolina; Gulfport, Mississippi; and Pocatello, Idaho) since 1969. The MAP program in 1978-79 has a total of 115 grade K-3 classrooms in 19 elementary schools which serve 3031 pupils. The fundamental goal of the program is to create classroom learning environments which stimulate cognitive growth. Piagetian theory serves as the model which emphasizes concrete and mental activities and sequenced intellectual challenges as necessary for intellectual growth. Consequently, the classroom learning environments are designed to provide for independent and small group activities matched to each child's level of conceptual development. In addition, the child's needs related to basic physical health and school-home relations are considered essential to his academic program. Therefore, comprehensive services, including school-home coordination, health services, social services, and nutrition programs, are maintained by the program.

Methodology

A wide variety of instruments has been used by the MAP-FT Program to assess the classroom implementation process and child outcomes in terms of academic achievement, cognitive development, and personal-social factors. The tests have been administered on a regular basis by the local school systems working with the model sponsor. For purposes of this paper, only the instruments used for measuring academic achievement in Grades 1 and 3 will be described.

In all sites, the Metropolitan Readiness Test was administered within the first two months of first grade. Because achievement tests were selected by sites, a number of different tests have been used. Included were: California Achievement Tests (CAT), Science Research Associates (SRA-AS), and Stanford Achievement Test (SAT-P2 and P3) all for grade 3. Readiness and achievement testing was conducted under the supervision of local school districts following the publisher's recommended procedures. In most cases, tests were administered by teachers in their own classrooms.

In order to provide for common academic content areas across the different tests, three "subsets" were defined (Mathematics, Language, and Reading) by summing various subtest scores. National Percentiles and Standard Deviation units were computed for these "subsets".

All children, MAP-FT and non-FT, in site project schools were administered the MRT. All children remaining in the respective programs at the end of Grade 3 were given the appropriate achievement tests. An average of 40% of MAP-FT children were from low-income families in contrast to only 23% of non-FT children.

Two analysis techniques were used: (1) Achievement scores of children who had received the MRT were submitted to an ANCOVA, using the MRT as a covariate; (2) MAP-FT/non-FT differences between raw achievement means were divided by the Standard Deviation (S.D.) for the national norm group to provide an estimate of "educational significance" in S.D. units. One quarter (.25) of a Standard Deviation difference between two groups has been interpreted as educationally meaningful in the national Follow Through study (Stebbins, St. Pierre, Proper, Anderson, and Cevera, 1977).

Results

Socio-economic status has been shown to be related to intelligence and achievement scores (Stodolsky and Lesser, 1967). Also, it has been demonstrated that differences in test scores attributable to SES tend to increase from Grades 1 to 5; i.e., the phenomenon described as "cumulative deficit" (Cooper, 1964; Deutsch, 1965; and Stickney, 1977). Despite this economic disadvantage, in 4 of 5 comparisons (ANCOVA's using Fall Grade

1 MRT as a covariate) in three sites, across three years, MAP-FT third graders scored significantly higher in mathematics than did local non-FT comparison groups. (Table 1)

Table 1

GRADE 3 MATHEMATICS ACHIEVEMENT

Community	Year	Cohort	Test	No. of Ss	Grade 1 MRT			Grade 3 Mathematics			F^b
					$\bar{X}$	%ile	Difference in S.D. Units[a]	$\bar{X}$	%ile	Difference in S.D. Units[a]	
Lee											
FT	1974	III	CAT	157	56.7	55	.11	100.1	54	.51	8.10*
NON-FT				20	58.7	59		90.0	37		
Lee											
FT	1975	IV	SRA-AS	159	60.3	61	.23	44.1	67	.72	26.59*
NON-FT				93	56.3	53		36.3	35		
Gulfport											
FT	1974	III	SAT-P2	96	49.0	38	.32	47.8	3	.38	33.55*
NON-FT				42	54.6	51		41.2	2		
Gulfport											
FT	1975	IV	SAT-P3	18	51.1	42	.42	49.3	40	.02	.86[c]
NON-FT				17	58.5	59		49.7	40		
Gulfport											
FT	1976	V	SAT-P2	52	55.8	53	.03	71.1	28	.03	
NON-FT				51	56.3	53		70.3	26		
Pickens											
FT	1975	IV	SAT-P3	68	56.3	53	.43	59.9	58	.12	6.82*[c]
NON-FT				29	63.9	69		57.8	54		
Pickens											
FT	1976	V	SAT-P3	68	62.6	67	.32	57.5	53	.09	
NON-FT				33	68.3	77		55.8	50		

*$p < .01$

[a] Based on national norms

[b] ANCOVA

[c] NOVA, FT vs NFT, 1975 and 1976 data combined

In the remaining comparison (Gulfport, 1975 and 1976) MAP-FT scored as well as non-FT.

The second interpretational strategy here involved a comparison of MAP-FT/non-FT differences in terms of Standard Deviation units. Using this criterion, the Grade 1 data (see Table 1) suggests that in three comparisons, MAP-FT children enter Grade 1 below non-FT and exit Grade 3 equal to non-FT; in two comparisons MAP-FT enter equal to non-FT and exit above non-FT; in one case MAP-FT enters below but exits above non-FT; and, in one case the two groups are equal at both time points.

The results in Language Achievement are shown in Table 2.

Table 2
GRADE 3 LANGUAGE ACHIEVEMENT

Community	Year	Cohort	Test	No. of Ss	Grade 1 MRT			Grade 3 Language			F^b
					$\bar{X}$	%ile	Difference in S.D. Units[a]	$\bar{X}$	%ile	Difference in S.D. Units[a]	
Lee											
FT	1974	III	CAT	157	56.7	55	.11	66.6	52	.82	7.91*
NON-FT				20	58.7	59		53.9	49		
Lee											
FT	1975	IV	SRA-AS	159	60.3	61	.23	46.7	45	.30	1.11
NON-FT				93	56.3	53		43.7	37		
Gulfport											
FT	1974	III	SAT-P2	96	49.0	38	.32	74.4	8	.55	55.27*
NON-FT				42	54.6	51		90.3	23		
Gulfport											
FT	1975	IV	SAT-P3	18	51.1	42	.42	77.8	33	.64	.33[c]
NON-FT				17	58.5	59		97.6	49		
Gulfport											
FT	1976	V	SAT-P2	52	55.8	53	.03	82.5	32	.02	
NON-FT				51	56.3	53		82.2	32		
Pickens											
FT	1975	IV	SAT-P3	68	56.3	53	.43	92.6	43	.07	.57[c]
NON-FT				29	63.9	69		95.0	45		
Pickens											
FT	1976	V	SAT-P3	68	62.6	67	.32	86.8	40	.46	
NON-FT				33	68.3	77		101.0	51		

*$p < .01$

[a] Based on national norms

[b] ANCOVA

[c] ANCOVA, FT vs NFT, 1975 and 1976 data combined

The ANCOVA's show that by Spring Grade 3, one group of MAP-FT children scored above non-FT, one MAP-FT group scored below non-FT, and three groups scored as well as non-FT in the language tests.

Comparisons using the Standard Deviation units suggest that in two cases MAP-FT enter equal to and exit above non-FT; in one comparison MAP-FT enters below and exits equal to non-FT; in one comparison MAP-FT enters and exits equal to non-FT; and in the three remaining comparisons

MAP-FT groups enter and exit below non-FT.

Finally, in Reading Achievement (Table 3) MAP-FT third graders scored significantly above non-FT in one comparison, equal to non-FT in three comparisons, and below non-FT in one comparison (using ANCOVA's). The Standard Deviation analysis suggests that in two cases MAP-FT enter equal to and exit above non-FT, in one case they enter equal to non-FT and retain their relative standing, and in four comparisons MAP-FT enter below and exit below non-FT.

TABLE 3

GRADE 3 READING ACHIEVEMENT

Community	Year	Cohort	Test	No. of Ss	Grade 1 MRT			Grade 3 Reading			r^b
					$\bar{X}$	%ile	Difference in S.D. Units^a	$\bar{X}$	%ile	Difference in S.D. Units^a	
Lee FT	1974	III	CAT	157	56.7	55	.11	63.3	35	.46	7.01*
NON-FT				20	58.7	59		54.9	26		
Lee FT	1975	IV	SRA-AS	139	60.3	61	.23	34.7	46	.28	1.36
NON-FT				93	56.3	53		31.5	40		
Gulfport FT	1974	III	SAT-P2	96	49.0	38	.32	41.9	1	.72	60.19*
NON-FT				42	54.6	51		54.3	8		
Gulfport FT	1975	IV	SAT-P3	18	51.1	42	.42	58.3	29	.60	.71^c
NON-FT				17	58.5	59		71.2	46		
Gulfport FT	1976	V	SAT-P2	52	55.8	53	.03	97.0	29	.04	
NON-FT				51	56.3	53		97.9	30		
Pickens FT	1975	IV	SAT-P3	68	56.3	53	.43	65.1	38	.42	2.18^c
NON-FT				29	63.9	69		74.2	50		
Pickens FT	1976	V	SAT-P3	68	62.6	67	.32	62.1	34	.34	
NON-FT				33	68.3	77		69.3	44		

$^*p < .01$

[a] Based on national norms

[b] ANCOVA

[c] ANCOVA, FT vs NFT, 1975 and 1976 data combined

Discussion

Much of the evidence reported here is based on small sample sizes with attrition rates approaching 20% annually. There was difficulty in obtaining representative samples through random selection or by testing the entire population. Where statistically significant results occur, however, these data most probably reflect actual differences.

The large number of different instruments applied to numerous samples across several years also strengthens the interpretation that the results are reliable. That is, fairly consistent results in the different achievement areas, using four tests and three sites over a three year period, suggest stability of results.

Many researchers are of the opinion that ANCOVA'S applied to our data are somewhat inappropriate since enrollment in MAP-FT and non-FT was not random (Campbell and Erlebacher, 1975; Horst, Tallmadge, and Wood, 1974). Therefore, an alternative comparison procedure based on Standard Deviation unit differences was used. The two analysis procedures yielded substantially similar results.

In a program designed to redress some of the academic problems of economically disadvantaged children, it is hoped that the cumulative deficit accruing across the elementary school years would be counteracted. In the data from these seven samples of children, in three different sites and for three different years, the MAP third grader children scored as well or better than non-FT children in mathematics achievement. Language and Reading Achievement results suggest, for the most part, that MAP-FT children scored close to their non-FT peers. The Standard Deviation Analyses suggests similar academic achievement results. Although not discussed in the preceding text, national percentiles were presented in

Tables 1-3. While there is a good deal of variation, 18 of the 21 MAP-FT percentile scores are well above the 20th percentile which Hodges and Sheehan (1978) suggest should be the base from which scores represent "an educational improvement" for children from low-income families.

The MAP-FT and comparison groups differed on a number of dimensions, including school readiness and family income, but a substantial proportion of the outcome similarities or differences between the groups at grade 3 can be attributed to the program. Multiple regression analyses of SRI classroom implementation variables, appropriate to MAP, onto various outcome change scores have consistently shown that the relevant MAP-FT classroom social interactions account for at least 10% of the outcome variance.

The relatively stable results presented in this paper suggest that MAP-FT is an effective educational intervention model for disadvantaged children. The cumulative deficit hypothesis has not been supported by data presented in this study.

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MAP-FT Project Evaluation Report

Pocatello, Idaho[1]

Prepared by

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April 1978

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Preface

This Project Evaluation Report is one of a series of reports designed to yield information which each community can use in assessing the strengths and weaknesses of Follow Through as it is locally implemented. In general, a number of studies suggest that while there are community differences, MAP-FT is achieving its goals. The conclusion from any research findings depends partially on the objectives of the interpreter. Reports of "high" and "low" scores may be interpreted in a variety of ways. A program which produces high spelling scores may consider itself a failure if, ideally, its teachers should have spent a small amount of time teaching spelling. A program which produces low scores in "cognitive" measures of ability to understand may consider itself a success, if the chief goal is to produce "factual" knowledge rather than to enhance the growth of more general intellectual abilities.

This series of Project Evaluation Reports could not have been generated without the cooperation of each of the local communities involved. The staff of MAP-FT wish to thank the project staffs, teachers, and children who have participated in the collection of data and who have provided many insightful criticisms incorporated in the final drafts.

P. Silverman, Evaluation Coordinator

Abstract

The Pocatello Mathemagenic Activities Program-Follow Through (MAP-FT) was designed to provide comprehensive educational services to first through third grade children from low-income families. Consistent with the Piagetian theory of intellectual growth, instructional environments emphasize learning by doing, individual decision-making, and presentation of academic curricula in sequential steps consistent with cognitive levels. Major goals of the program are (1) to decrease or stabilize the academic gap between disadvantaged and advantaged children by facilitating their intellectual and academic development, (2) to develop a system for training local staff to implement the instructional model, (3) to involve low-income parents in the decision-making processes of the educational system, and (4) to provide medical, dental, nutritional, and psychological services. A project staff including a director, two resource teachers, aides, a parent coordinator, school-home coordinator, nurse, and social worker function to implement the entire program.

Progress towards the achievement of these goals has been assessed using a variety of instruments between fall, 1973 and spring, 1977, including tests of school readiness levels, intellectual and academic abilities during enrollment and following graduation from the program, parent biographical questionnaires, and program service records.

Although MAP-FT children are more biographically and academically disadvantaged than NFT (non-Follow Through) children, 1975-76 test results indicate that Pocatello MAP-FT children may develop at a faster intellectual rate than both NFT children and children in MAP-FT classrooms of three other communities. In addition, Pocatello MAP-FT children appear to apply intellectual abilities

to academic areas to a greater extent than do NFT children. Results of achievement tests administered to children in grades 2 and 3 (spring, 1976 and 1977) suggest that differences between MAP-FT and NFT children decrease or remain constant in all academic areas. Analysis of scores on achievement tests administered to children in grades 3 and 4 (spring, 1976 and 1977) suggest that immediately following enrollment in the program (i.e., from the end of grade 3 to the end of grade 4) achievement differences between MAP-FT and NFT children continue to decrease or to stabilize in all academic areas.

Documentation of the implementation system for 1976-1977 shows that MAP-FT teachers participate in activities and receive services not available elsewhere in the community, including: widespread use of aides and parent volunteers, large numbers of pre- and inservice workshops and individual conferences with resource personnel, and classroom instructional materials developed by resource teachers and the University of Georgia MAP-FT sponsor. MAP-FT parents received home visits from social services personnel and participated in workshops, had major policy input through a MAP-FT Policy Advisory Committee, and received education newsletters. MAP-FT staff developed public information presentations and materials. Finally, MAP-FT children received more free or partially subsidized medical and dental examinations and referrals, and more free breakfasts, than did NFT children.

The MAP-FT program appears to have been successfully implemented. Despite a number of evaluation problems, including some cross-sectional sampling, use of somewhat inappropriate NFT comparison groups, and lack of detailed school readiness information, evaluation results suggest that the cumulatively increasing deficit, which has characterized the plight of educationally disadvantaged children, has been stemmed and, in some areas, reversed.

MAP-FT Project Evaluation Report: Pocatello, Idaho

Paul S. Silverman

Community and Project Description

Pocatello is a relatively isolated community of approximately 40,000 located in Bannock County (pop. 52,000), southeastern Idaho.[1] The community is a regional railroad hub with major industries including agriculture, railroading, production of phosphate fertilizer and elemented phosphorous, retail trade, and Idaho State University. In 1970, the median family income in the county was $8,871, with 10% of the adult population living below the low-income level. Five point four percent of the population was unemployed with four percent receiving aid for dependent children. The community is largely caucasian with a small minority group of Native Americans. The Mathemagenic Activities Program-Follow Through (MAP-FT) was implemented in Pocatello in the 1970-71 school year as part of the "Economic Opportunity Act". . ."to meet the instructional, physical, and psycho-social needs of young children from low-income families in a program of comprehensive services and parent participation activities" (Follow Through Program Manual, February 24, 1969). Of the 16 elementary schools and 109 first to third grade classrooms in School District #25, Bannock County, 5 schools contain a total of 21 Follow Through (FT) classrooms as well as traditional Non-Follow Through (NFT) classrooms. All FT schools are located in neighborhoods serving primarily low-income families.

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[1] 1970 U. S. Census data.

MAP-FT Description

As in all Follow Through projects, the Pocatello project is organized to .fer both instructional and noninstructional services to children of low-income families.

The instructional component of the Pocatello MAP-FT project includes classroom practices based on the following principles derived from the Piagetian theory of development: (1) Cognitive and affective development are products of interactions between the child and his environment. It is not sufficient that the child merely copy his environment; he must be allowed to actively construct an interpretation in terms of his own level of development, (2) the child's interactive exchanges with the environment must be at both the mental and physical level of activity, (3) the child is attracted and challenged to learn by tasks representing the next step beyond his current experience and knowledge level. Thus, the emphasis is on learning by doing and individual decision-making on the part of the child. Instructional strategies are designed to create a learning environment that: (1) provides an appropriate discrepancy between the child's current level of functioning and task requirements (Mismatch); (b) requires the child to engage in coordinating actions, both physical and symbolic (Activity); and (c) provides multiple options for the child in terms of task difficulty and task type (Personal regulation). These instructional strategies are reflected in specific physical and social characteristics of the ideal MAP-FT classroom. Typical physical characteristics include small group or individualized activity settings geared to each child's cognitive and academic level, child-selected seating arrangements and workgroups, instructional activities involving concrete objects and activities, and accessible classroom learning centers. Social interactions involving open-ended questions, praise, and general attention from teachers and aides, as well as child-initiated interactions with adults, children interacting with each other, and children instructing themselves are also characteristic. The interlocking nature of different curriculum contents (e.g., overlap of Science, Art, Language) creates possibilities for the coordinated development of intellectual processes and skills through a variety of media, activities, and social situations. In addition to the teacher, each first and second grade classroom contains two instructional aides (third grades contain one), supplemented by parent volunteers, in order to provide a high level of social interaction in small group instructional task situations. Teachers, aides, and volunteers are subject to continuous in-service training, consultation, and monitoring by two resource teachers, by consultants, and by MAP-FT sponsor staff at the University of Georgia.

The Pocatello non-instructional component is composed of staff and activities designed to facilitate the involvement of parents in the education of their children and in the functioning of the program as a whole. A Parent Coordinator and a School-Home Coordinator offer parent-development workshops and encourage parents to participate in school activities. In addition, "non-instructional" services such as dental, medical, psychological, and nutritional care are offered to children. A Social Worker and a Nurse identify community resources and coordinate delivery of these services. All low-income children receive free or partially subsidized breakfasts and lunches prepared by staff cooks.

Program Goals

Low social economic status, typical of many MAP-FT families, has been found to have an adverse effect on children's intellectual skills (Stodolsky & Lesser, 1967). Furthermore, this disadvantage tends to increase with age

(Bloom, 1964; Gordon, 1965; Karp & Sigel, 1965). The chief goal of the MAP-FT program is to facilitate the intellectual development of children enrolled in its classrooms by providing an enriched instructional environment. By doing so, it is hoped that the typical pattern of increasing, or "cumulative", intellectual and academic deficits will be changed, and that children will be better prepared to take advantage of educational experiences offered after they exit from the program. A second goal is to involve low-income parents in the decision-making processes of their educational system. This goal has two-fold implications: (1) It is expected that by working with teachers and aides, parents will contribute to both the academic motivation and the competence of their children, and (2) Parent involvement in the educational program should improve the overall quality of the local educational system and "institutionalize" a continuing source of change and improvement. The achievement of some of these aims is examined in this report using the following criteria for "success":

(1) Intellectual and Academic Development

(a) By spring, grade 3, exiting Follow Through (FT) children who initially showed academic deficits and disadvantaged biographical characteristics relative to Non-Follow Through (NFT) controls, should equal NFT on cognitive measures and achievement, or should have decreased the differences between their scores and NFT scores.

(b) Children in the FT program should apply cognitive abilities to mastery of academic content areas to a greater extent than do NFT children.

(c) In spring, grade 4, children formerly enrolled in the FT program should equal NFT children in academic achievement, continue to show a decrease in the differences between their scores and NFT scores, or stabilize deficits that remained in grade 3.

(2) Instructional Environment

The Pocatello Follow Through Program should have developed a system for training local staff to implement the instructional components of the Mathemagenic Activities Program.

(a) Follow Through classrooms should have more full-time aides than do Non-Follow Through classrooms.

(b) Follow Through teachers and aides should have received more pre- and in-service workshops than did NFT teachers and aides.

(c) Follow Through teachers should have received more in-service evaluation and consultation than did NFT teachers.

(d) Follow Through aides should have received more career development courses than did NFT aides.

(e) Follow Through resource teachers should have introduced new materials and teaching techniques, otherwise unavailable to Follow Through teachers.

(f) Follow Through resource teachers should have attended instructional workshops.

(g) Follow Through parents should be serving as classroom volunteers more often than do NFT parents.

(3) Parent and Community Involvement

Follow Through parents should have input into the decision-making process of the program and should be involved in educational activities with their children.

(a) Follow Through parents should have received more at-home help from social services personnel than did NFT parents.

(b) Follow Through parents should be serving as volunteers in both instructional and non-instructional activities more often than do NFT parents.

(c) The Follow Through Policy Advisory Committee (PAC) should have made input into the policy decisions of the FT program.

(d) Follow Through parents should have participated in workshops and conferences more often than did NFT parents.

(e) Follow Through parents and staff should have undertaken activities designed to increase public awareness of the importance of early childhood education in general and Follow Through in particular.

(f) A parent communication system should have been established.

(4) Non-instructional Services

Follow Through children and parents should have received dental, medical, nutritional, and psychological services.

(a) Follow Through children should have received more free or partially subsidized medical examinations, treatment, and referrals than did NFT.

(b) Follow Through children should have received more free or partially subsidized dental examinations and referrals than did NFT.

(c) Follow Through children should have received more free or partially subsidized psychological services and referrals than did NFT children.

(d) Follow Through children should have received free breakfasts and lunches more often than did NFT.

Evaluation Procedures

Intellectual and academic development were examined for three groups of children: (1) A "cross-sectional" group enrolled in grades 1, 2, and 3 in 1975-76, (2) a longitudinal group of children who were enrolled in grade 1 in Fall, 1973 and left grade 3 in Spring, 1976 (the fourth "cohort" to pass through the program), and (3) another longitudinal group of children who entered grade 1 in Fall, 1974 and exited grade 3 in Spring, 1977 (the fifth "cohort" to pass through the program). Grade 4 (1977) post-Follow Through achievement data were available for the second group of children. The instructional environment, parent and community involvement, and non-instructional services were evaluated for the 1976-77 school year using records maintained by FT staff and by administrators and teachers.

Descriptions of samples and instruments which follow refer to data used to examine intellectual and academic development.

Sample Sizes and Instruments

(1) Cross-sectional group, 1975-76. In 1975-76 the MAP-FT evaluation program undertook a study of the effects of FT enrollment on children's achievement and cognitive abilities in Pocatello. Several measures were collected. In the winter of 1975-76 a group-administered conservation test, the Purdue Conservation Film (alpha reliability = .85, Wheatley, 1974), designed to determine the stage of intellectual development of children, was administered to a total of 280 children in three FT and three NFT classrooms randomly selected at each of grades 1 and 3, and three FT and two NFT classrooms at grade 2 (NFT classrooms were examined only in school buildings which also contained FT classrooms). Based upon Piaget's theory of intellectual development, the Purdue Conservation Film measures children's abilities to understand concepts requiring logical thinking,

such as the idea that length, number, area, weight, volume, and quantity do not change unless additions or subtractions are made. Typically children are incapable of these concepts before the age of 6 or 7. That is, they make judgments based only on static appearances.

To permit a detailed examination of program effects, a parent biographical questionnaire was distributed by teachers to all parents of children (FT and NFT) in grades 1, 2, and 3 in FT schools at spring "Parent-Teacher Conferences" (Appendix 1). Parents were told that the information was confidential and were asked to complete the written questionnaires, seal them in envelopes labeled only by an anonymous identification number, and return them to a monitor in the hall as they left the building. Of the 240 FT and 170 NFT parents receiving the questionnaire, 93% of FT parents and 87% of NFT parents returned their forms. Approximately 25% of both groups' questionnaires were incomplete and could not be used.

Achievement tests were administered to all FT and NFT children in grades 1 and 3 and to all children in grade 2 who had received the Purdue Conservation Film (again, only in schools containing FT classrooms). In spring, 1976, 119 first graders received the Stanford Research Associates (SRA) Achievement Test, Primary-1, and 133 second and 109 third graders received the SRA Primary-2. Fall, grade 1 Metropolitan Readiness Test (MRT) scores were available for first graders (1975) and third graders (1973). Second graders had received no MRT.

(2) Longitudinal group, cohort 4. Fifty-one FT and 40 NFT children receiving Fall, grade 1 (1973) MRT, Spring, grade 3 (1976) SRA-P2, and Spring, grade 4 (1977) SRA-Blue Achievement tests were identified.

(3) Longitudinal group, cohort 5. In 1976-77, SRA-P2 achievement tests were administered to 75 FT and 58 NFT children in grade 3 who had received achievement tests in grade 2, 1976 (SRA-Primary-2) (these children had received no Fall grade 1 readiness tests).

Sample Description

1975-76 School Year. Results of the Parent Questionnaire indicate that on each of nine indices assessed, FT families were less culturally advantaged than NFT (Figure 1). While 88% of NFT families were supported by the father or male guardian, 67% of FT families were. Twenty-one percent (21%) of FT families were supported by the mother, compared to only 6% of NFT families. FT families also tended to be larger: 33% of FT families had five or more children, compared to 23% of NFT families. The effects of these large families on the well-being of individual children may have been aggravated by the relatively low FT family incomes: 68% of FT families had monthly incomes equal to or less than $900; only 31% of NFT families had incomes equal to or lower than this figure. While both FT and NFT families were mobile, FT families tended to move more often and their children had attended more schools: 48% of FT families had lived in two or more houses during the time their FT children attended school and 46% of FT children had attended two or more schools. In contrast, 36% of NFT families had lived in two or more homes, while 32% of NFT children had attended two or more schools. FT children may have been exposed to fewer books. While 24% of FT families had 24 or fewer books in their homes, only 5% of NFT families had this low a number. Fewer FT parents were married than NFT (73% vs. 92%). Finally, FT parents had fewer educational opportunities than NFT. While 28% of FT fathers had not graduated from high school, only 13% of NFT fathers had not completed their high school educations. Mothers' educational levels showed the same trend, with 35% of FT mothers and only 10% of NFT mothers failing to complete high school.

A readiness test (MRT) administered to all children (144 FT, 173 NFT) entering first grade in 1975 showed that while FT children were in the 55th national percentile, NFT children were in the 81st.

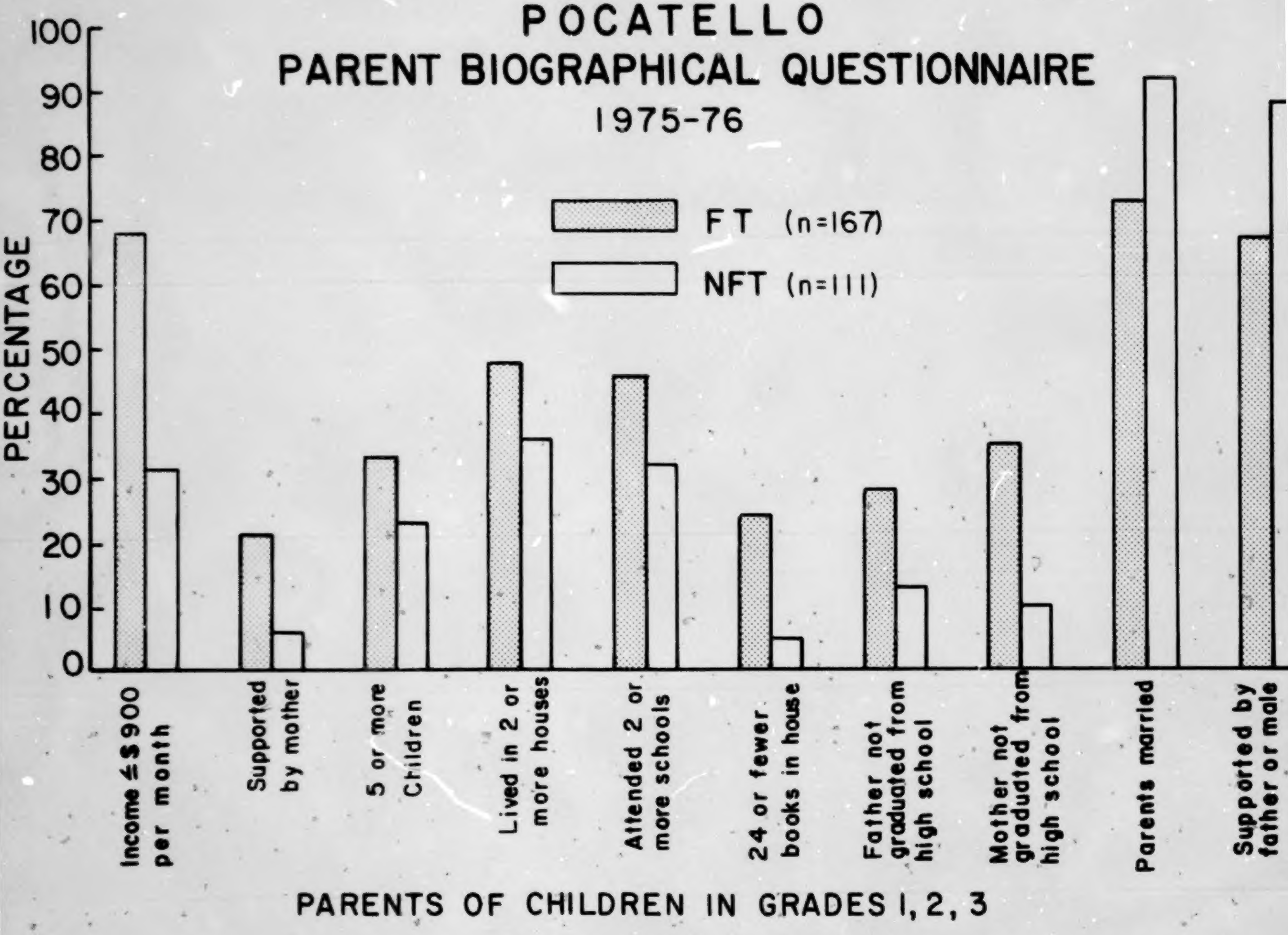

Fig. 1

POCATELLO
PARENT BIOGRAPHICAL QUESTIONNAIRE
1975-76

Of the several factors assessed, those which correlated most consistently with achievement and conservation scores across the three grade-levels were total MRT scores, father's education, and family income. Mother's education and number of books in the home also correlated with these measures of children's abilities (see Appendix 2). Since FT families were disadvantaged relative to NFT on these factors, their children could be expected to do less well than NFT in academic and cognitive areas.

1976-77 School Year. Although no biographical questionnaire data were available for these children, race and income were documented. For third graders there was no information for 76% of the children and the validity of the remaining demographic statistics was questionable. In addition, third graders had not received the MRT in the fall of first grade and academic readiness could not be determined. For fourth graders, however, where only 4% of the ethnic records were missing, 77% of FT children were White, 2% Black, and 21% were Native American (N=53). Ninety-four percent (94%) of NFT children were White, 3% Black, and 3% Native American (N=37). Regarding income, where 11% of the records were missing, 64% of FT children were from low-income families (total FT N=52) compared to only 3% of NFT children (total NFT N=33).[2] MRT entry data show that while NFT children were at the 81st percentile (N=40), FT were at the 69th (N=53). The trends in economic and readiness differences found in 1975-76 were repeated. This is not surprising since many of the families of these fourth graders were examined the previous year using the questionnaire.

It is particularly notable that both FT and NFT children scored above the 50th percentile on readiness tests. This finding was unexpected, given the biographical disadvantages of the FT group, and suggests either that other aspects of family life have overcome these disadvantages, that preschool enrollment was common and effective, or that an irregularity in administration of the MRT artificially increased children's scores.

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[2] Low-income defined using a formula including family income, family size, and urban setting. For an index of "low-income", the reader may refer to Department of Health, Education and Welfare, Office of Education: Follow-Through Program, Washington, D. C. Federal Register. 1974, Vol 39, No. 121, Part II.

Results

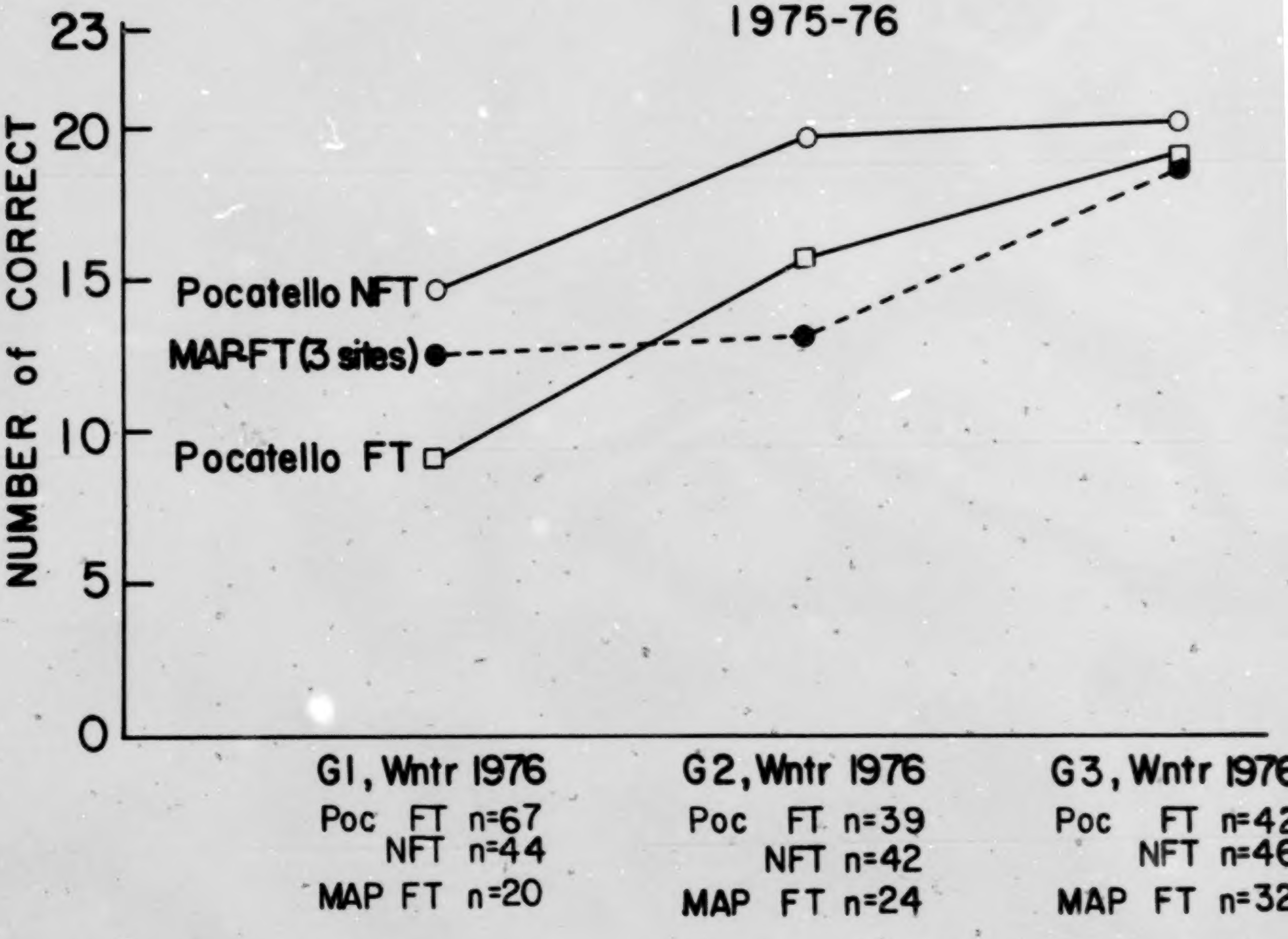
Intellectual and Academic Development

Intellectual development of a cross-sectional group (1975-76). Figure 2 presents the average "conservation" scores for three groups of children in grades 1, 2, and 3 during the 1975-76 school year: (a) Pocatello MAP-FT children, (b) Pocatello NFT children in "MAP-FT" schools, (c) MAP-FT children in three southeastern communities. As noted earlier, the Pocatello Follow Through group was composed of chiefly low-income children with backgrounds not conducive to academic achievement while the Pocatello NFT is not. The "three-site" group was composed exclusively of low-income children. While Pocatello children were tested in January, children in MAP-FT classrooms of the other three communities were tested in May. A five-month difference in dates of administration for these two groups is a significant one on this sensitive measure and places the "three-site" MAP-FT children at an advantage. All curves show the expected developmental trend, a phenomenon which typically occurs irrespective of schooling experience. Also as expected the relatively culturally "advantaged" NFT group scored significantly higher than the Pocatello FT group (statistics in Appendix 3). The difference between both FT groups and the NFT group decreases with each grade level. This trend, however, can not be attributed solely to effects of the FT program since, with few exceptions, children who begin at a deficit always learn to conserve, regardless of schooling experience. A comparison between the Pocatello MAP-FT

Fig. 2

POCATELLO: CONSERVATION

1975-76



and the 3-site MAP-FT groups does suggest that the Pocatello program produces an impact relative to the other MAP sites. While Pocatello FT first graders score lower than the 3-site group in grade 1, grade 3 Pocatello FT scores are equal to the 3-site group. Caution should be exercised here, however, since the group is a cross-sectional one and thus only represents rates of change.

Pocatello MAP-FT children also appear to be applying their cognitive developmental acquisitions to academic content areas to a greater extent than do NFT. Figure 3 presents three graphs, depicting MAP-FT and NFT correlations of Mathematics (3a), Reading (3b), and Language (3c) achievement scores with conservation scores at grades 1, 2, and 3. Subjects were a subgroup of the Pocatello MAP-FT and NFT samples described in Figure 2.[3] All grade 1 and 2 correlations are significantly different from zero ($p<.05$) although the only significant correlation in grade 3 is for FT Math and conservation. Similar trends occur in both the Pocatello MAP-FT and NFT curves. With one exception (NFT, 3a) each correlation reaches a peak (indicating a relatively strong relationship) in grade 2. This increase followed by a decline suggests that as the logical ability to conserve develops, it is reflected in academic achievement. As the children master conservation, the relationship with achievement decreases since more advanced cognitive abilities are applied to academic areas. In both Mathematics and Reading the MAP-FT group appears to apply cognitive developmental problem-solving skills to academic areas more than does the NFT group (though differences between the two groups are not statistically significant). This same trend has been reported

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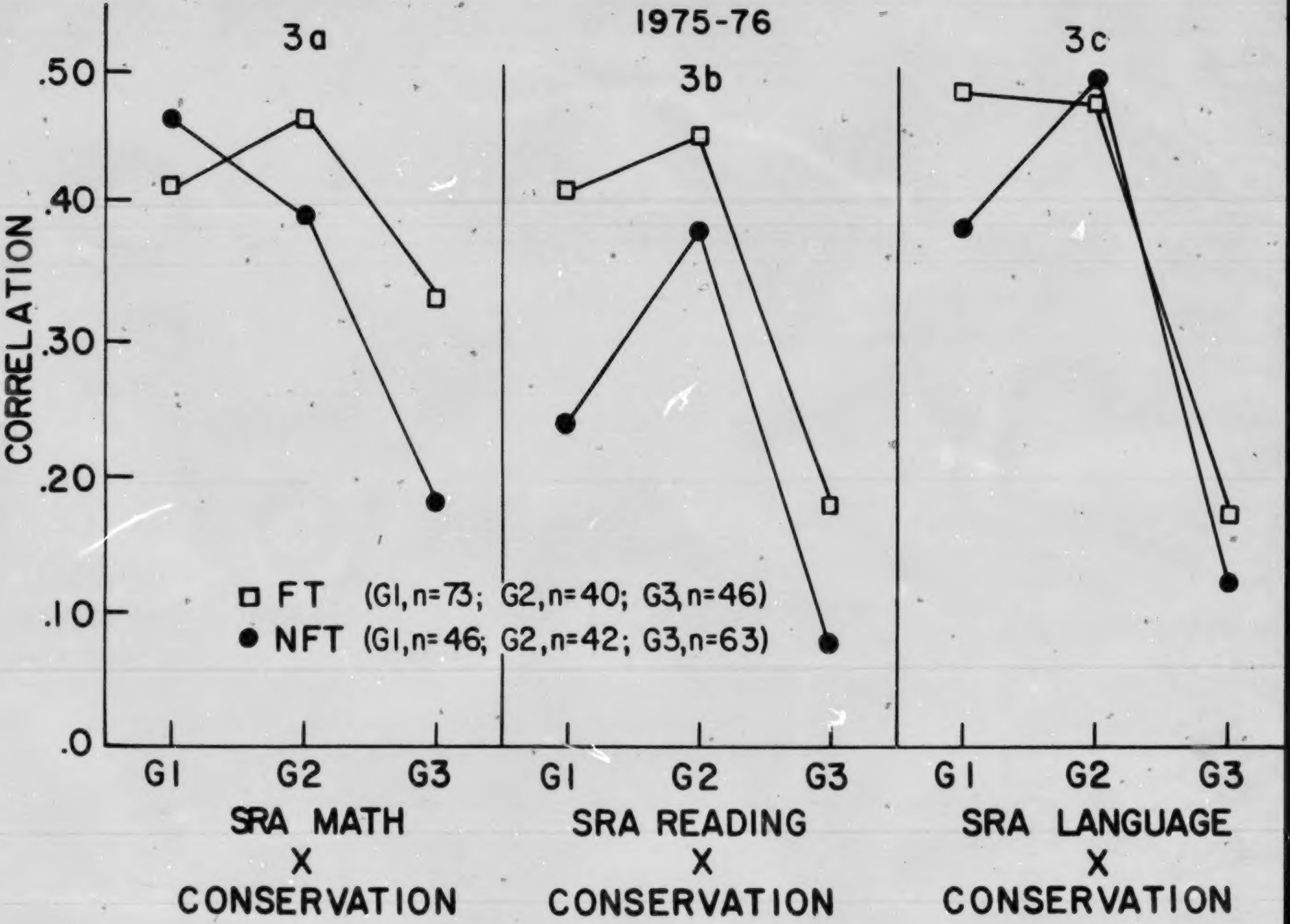
[3] "Correlation" is a statistical technique for estimating the degree of relationship between two measures. A positive correlation (+) indicates that increases in one measure are associated with increases in the other. A negative correlation (-) indicates that increases in one measure are associated with decreases in the other. A perfect correlation would be +1.00 (or -1.00).

Fig. 3

POCATELLO

CORRELATIONS *between* ACHIEVEMENT *and* CONSERVATION

1975-76



for a longitudinal group in another MAP-FT community (Kerkman, Silverman, & Smock, 1976) and suggests one unique effect of the program.

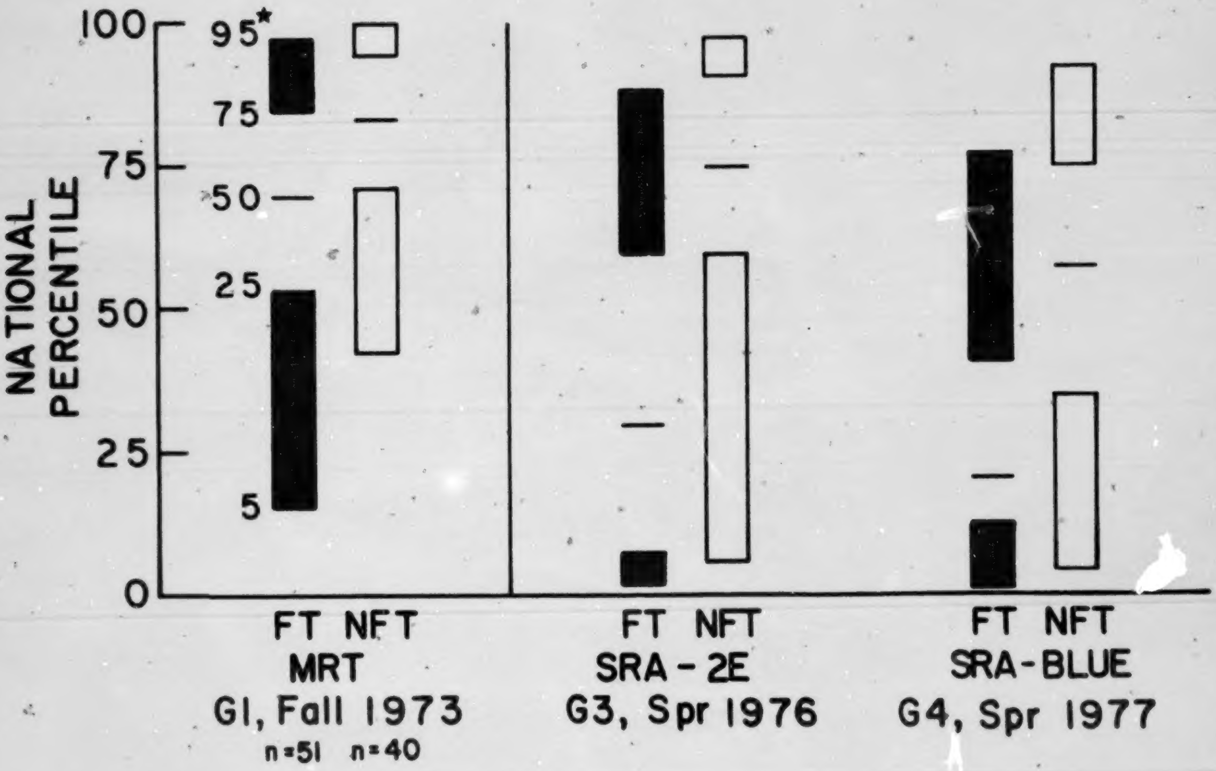
Academic development of cohort 4, grades 1-4 (1973-77). Figures 4, 5, and 6 show the means and percentile ranges for a single group of MAP-FT and NFT children as they entered grade 1 (Fall, 1973; MRT), exited grade 3 (the last year of MAP-FT enrollment: Spring, 1976; SRA-2E), and exited grade 4 (a "post-FT" year, Spring, 1977; SRA-Blue). Each figure focuses on a separate subtest: Figure 4, Mathematics; Figure 5, Reading; Figure 6, Language. A number of qualifications and an explanation of the composition of these figures are warranted. Data for the three time points are based on different tests. Grade 1 scores are based on total readiness scores in a variety of areas. While grade 3 and 4 scores are derived from subtests which ostensibly measure achievement in the same areas, the tests are different in composition and level of difficulty. Because the tests are different, the reader is cautioned to keep this in mind in interpreting "changes" from one year to another. A vertical line has been drawn between bars representing MRT scores and those in the rest of the graph to remind the reader that overall readiness is a measure which does not correspond to the grade 3 and 4 subtests.

The bars on the graph itself were computed first by identifying FT and NFT raw scores which fell into the 5th, 25th, 50th, 75th, and 95th local percentiles. The raw scores which correspond to the five local percentiles were then transformed to national percentiles. For example, a FT third grader scoring above 95% of the other FT children in Mathematics was determined to have a raw score of "51". A child with this raw score falls at the 88th national percentile. Recalling that this same score represents the 95th local percentile, we can conclude that the FT children at the 95th "local" percentile fell 7 percentile points (95 minus 88) below the national norm group. Or, stated differently, the "highest" FT group scored somewhat

Fig. 4

POCATELLO

MATHEMATICS

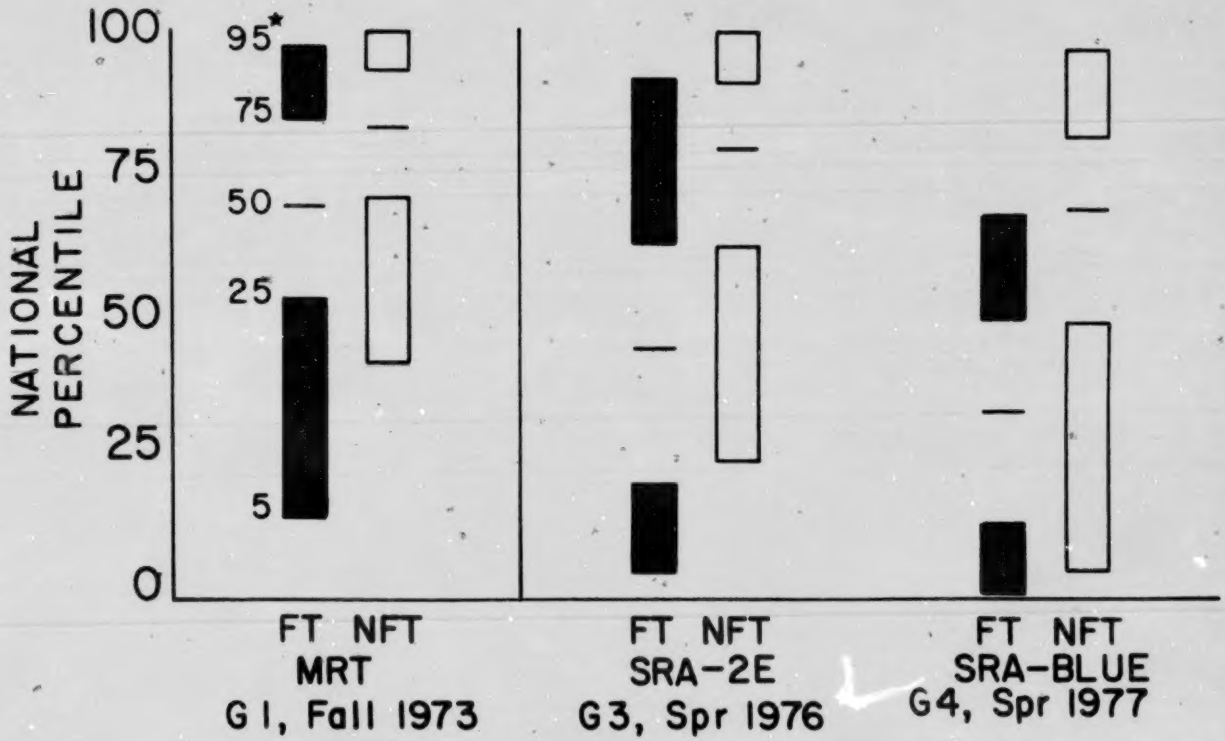


* Local Program Percentile

Fig. 5

POCATELLO

READING

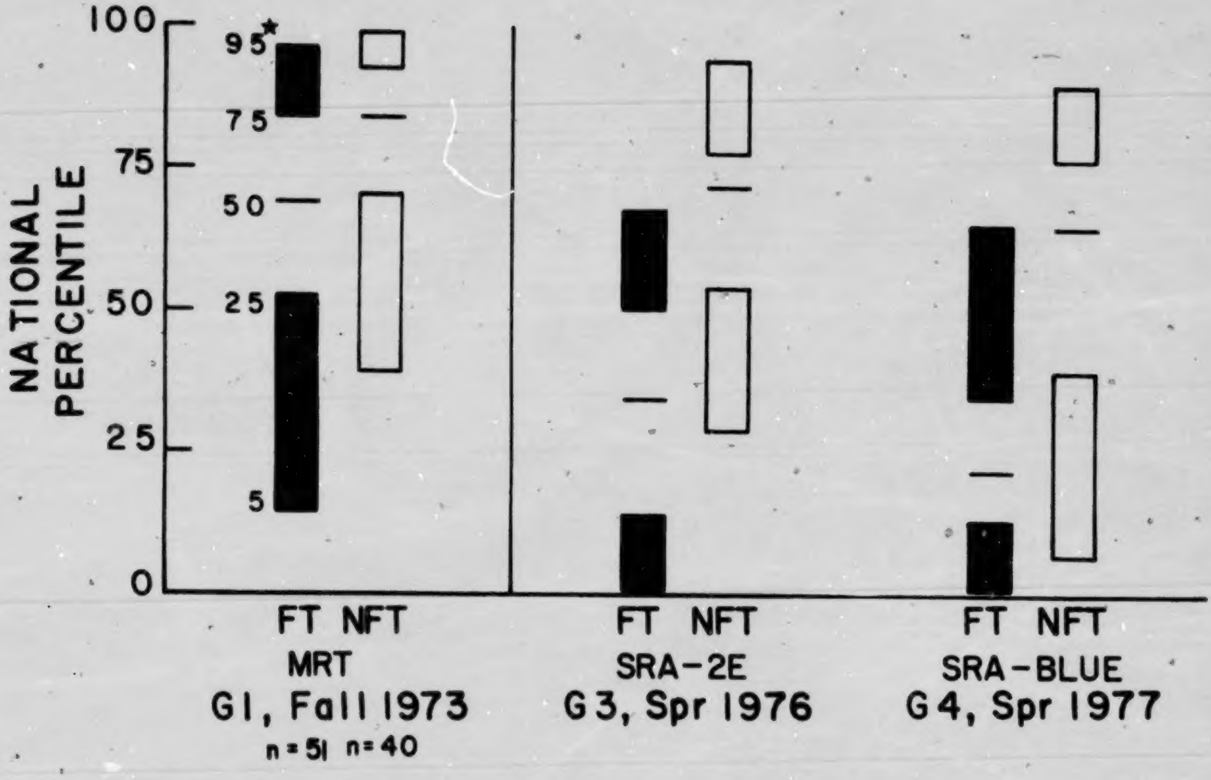


*Local Program Percentile

Fig. 6

POCATELLO

LANGUAGE



*Local Program Percentile

below the "highest" national group. The bars on Figures 4, 5, and 6 represent two ranges: the 5th to 25th local percentiles and the 75th to 95th local percentiles. The short horizontal lines which lie between pairs of bars represent the local 50th percentile, or mean.

While these figures are somewhat complex, the information they impart is quite valuable. First, FT and NFT groups can be compared with each other using the national norm group as a "standard" of measurement and they can be compared with the national norm group itself. Second, scores at different time points and from different tests can be compared with one another (the reader should note, however, that different national norm groups were used at each time point). Third, the performances of different groups of children can be compared. In Figure 4, for instance, while both the FT and NFT 50th local percentiles edge downwards from grades 3 to 4 relative to the national 50th percentile, and while the FT local 95th and 75th percentiles drop more rapidly than the NFT local 95th and 75th, the FT 25th percentile rises while the NFT 25th percentile drops. The interpretation might be made that there has been a positive FT impact on children in the lower local percentiles. This interpretation, of course, must be weighed against an alterative: The difference may be due to a statistical "regression towards the mean", a "natural" tendency for deviate cases to become less deviate with time.

With respect to the interpretation of each figure, Figure 4 suggests that between grades 3 and 4: (a) the Math scores of both FT and NFT groups drop relative to the national norm, (b) the Math scores of the FT 25th percentile rise, while those of NFT drop, (c) the differences between the FT and NFT 50th local percentile decrease. The Reading Achievement scores of Figure 5 show: (a) both FT and NFT groups drop relative to the national norm, (b) the FT 95th and 75th local percentiles drop more rapidly than NFT between grades

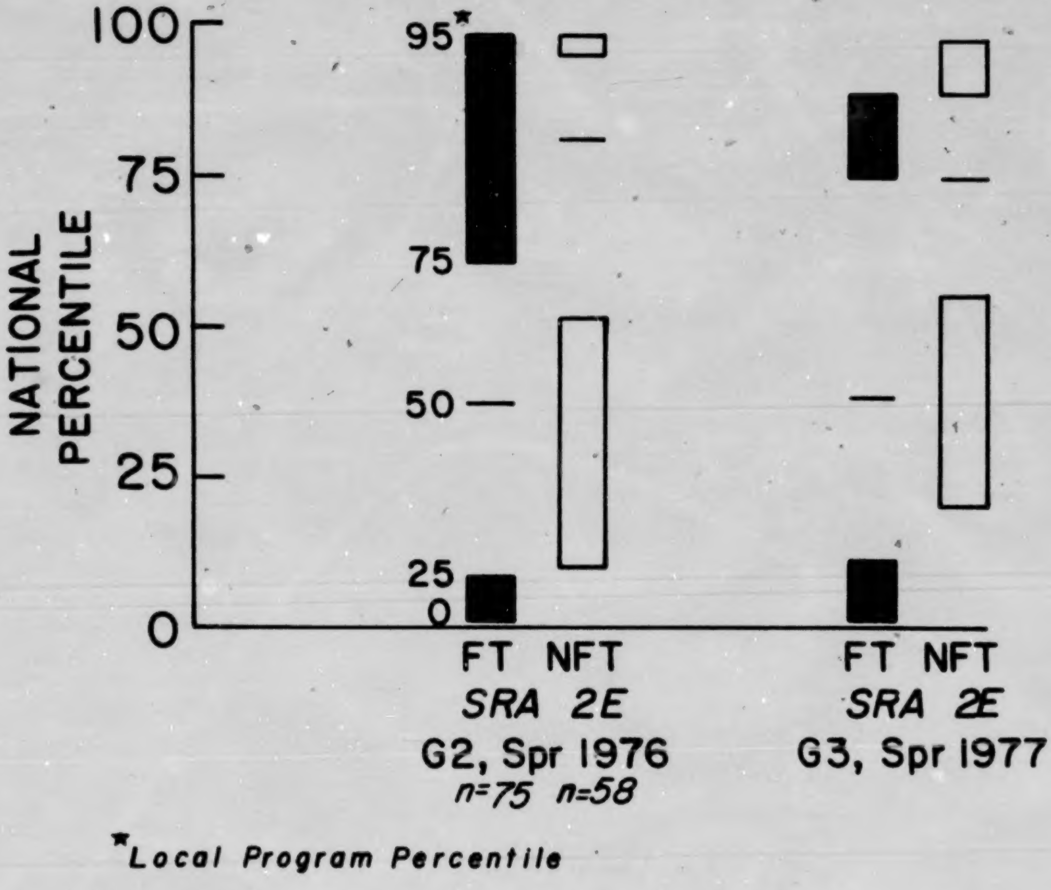
3 and 4, (c) the FT 25th local percentile drops less rapidly than NFT, (d) the differences between the FT and NFT local 50th percentile remain constant. As Figures 4 and 5, Figure 6 (Language) shows: (a) both FT and NFT groups drop relative to the national norm, (b) the FT 25th local percentile drops less rapidly than the comparable NFT local percentile, and (c) the differences between the FT and NFT local 50th percentile remain constant.

A general pattern emerges: relative to the national norm, the performance of both FT and NFT groups drops from grade 3 to 4. However, though FT children score lower than do NFT, their scores drop less rapidly or at the same rate. FT appears to be of benefit to children in the lower percentiles, causing their scores to rise (Math, 25th percentile), to remain constant (Language, 25th percentile), or to drop less than NFT (Reading, 25th percentile). As noted earlier, rather surprising are the high readiness scores of both FT and NFT in grade 1; higher in fact than the national groups. Also notable were the relatively high achievement scores of the NFT group. Though there were marked drops from 3rd to 4th grade, the NFT children generally scored above the national groups. Finally, the reader should note that the grade 3-4 changes reflect post-FT effects; that is, possibly lasting impacts on FT children after they have left the program. We have not interpreted percentile changes for grade 1 through grade 3, since (as noted earlier) these readiness and achievement tests do not measure the same content areas. Appendix 4 contains the results of statistical tests (ANOVAs) applied to each test at each time point, contrasting FT and NFT scores. As anticipated, NFT means were significantly higher than FT.

Academic development of cohort 5, grades 2-3 (1976-77). Figures 7, 8 and 9 (Mathematics, Reading, and Language) present percentile information computed as described above for cohort 4. No readiness MRT tests were administered to these

Fig. 7

POCATELLO MATHEMATICS

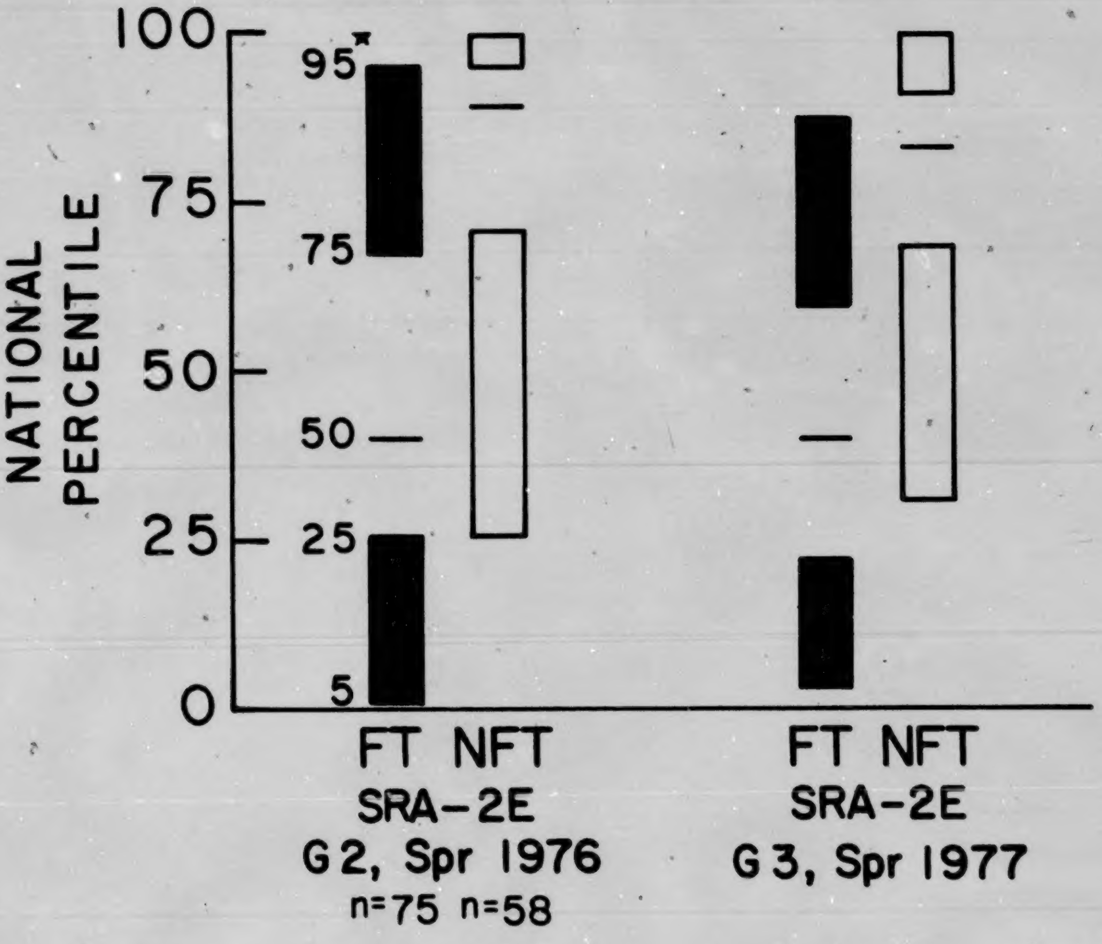


*Local Program Percentile

Fig. 8

POCATELLO

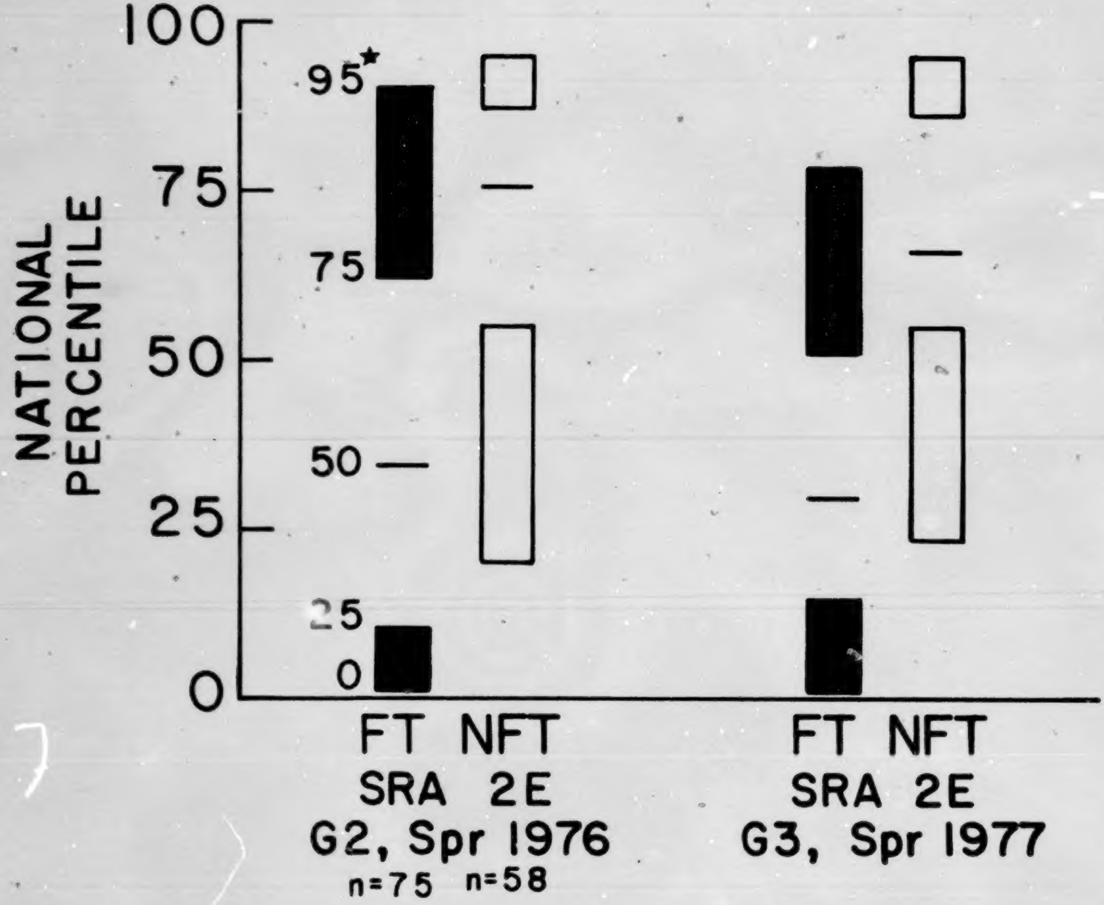
READING



*Local Program Percentile

Fig. 9

POCATELLO
LANGUAGE



*Local Program Percentile

children and grade 1 data could not be presented. These figures show achievement scores on the same achievement test administered during enrollment in FT (or NFT) grades 2 and 3. Because changes in percentile ranks are based on the same norm groups and tests, the reader can be confident in interpreting differences as true increases or decreases. Though the grade levels do not correspond to those in Figures 4, 5, and 6 (cohort 4), the overall trends are quite similar. In Mathematics (Figure 7), (a) the FT 75th local percentile rises relative to the national norm, in fact scoring identical to the national 75th percentile at grade 3, while the NFT group drops, (b) both the FT and NFT local 25th percentiles rise, (c) while the NFT local 50th percentile drops, the FT 50th percentile remains stable. In Reading (Figure 8) quite similar trends appear for FT and NFT with two exceptions: (a) the FT local 75th percentile drops more than the NFT and (b) both local 25th percentiles remain constant. Figure 9, Language, shows that while the NFT local 25th percentile drops slightly, the FT local 25th percentile rises somewhat. As in other graphs, the differences between the FT and NFT local 50th percentile decrease.

A pattern much like the earlier cohort emerges: the performance of the NFT 75th and 50th percentiles tends to drop while other percentiles remain stable or rise. With the exception of Mathematics, where there is an increase, the FT 75th percentile also drops, as does the 95th percentile and 50th percentile. However, the FT 50th percentile drops less rapidly than the NFT 50th. These effects may reflect the positive impact of FT during enrollment in the program. In Mathematics and Language the FT 25th percentile actually rises and in Reading the FT 5th percentile rises. As found in cohort 4, the 50th percentile of FT and NFT groups drop over time, though the NFT group continues to score markedly above the national norm. Appendix 5 contains the results of statistical tests (ANOVAs) applied to each achievement subtest at each time point, contrasting FT and NFT scores. As for cohort 4, NFT means were significantly higher than FT.

Summary. Attainment of the three program goals (a., b., c.; page 4) was supported:

(a) 1. Cohort 5 data suggest that FT-NFT achievement differences decrease or stabilize between grades 2 and 3 in all academic areas.

2. Cross-sectional data suggest that Pocatello FT children develop more rapidly than MAP-FT in three other sites and than local NFT children.

(b) Correlations between achievement and conservation scores of the cross-sectional data suggest that FT children apply cognitive-developmental logical abilities to curriculum areas more than do NFT children.

(c) Cohort 4 data suggest a post-FT impact showing that FT-NFT achievement differences decrease or remain constant between grades 3 and 4 in all academic areas.

Instructional Environment. Data are presented for the 1976-77 school year. Achievement of all program goals (a. - g.; page 5) was confirmed:

(a) There were 36 instructional classroom aides for 21 Follow Through classrooms in School District #25 for the 1976-77 school year. In contrast, there were 34 classroom aides for the remaining 79 elementary classrooms in the district.

(b) All 21 Follow Through teachers and 35 aides attended four pre-service instructional sessions. Nineteen in-service workshops for teachers and five for aides were held specifically for Follow Through personnel throughout the year. These included sessions on classroom management, educational history, learning center ideas, working with parent volunteers, and specific Follow Through curriculum areas. In contrast, non-Follow Through teachers attended no pre-service sessions and seven in-service workshops.

(c) A minimum of 60 individual conferences were held between the Follow Through Resource teachers and Follow Through classroom teachers throughout the year. This was a minimum of three conferences per Follow Through teacher. No such Resource Teacher services were available to district non-Follow Through teachers.

(d) During the year 11 Follow Through aides were enrolled in college credit classes and 17 aides were involved in vocational training classes available through the university. In all, 28 of 35 Follow Through aides were enrolled in some form of career development. In contrast, non-Follow Through teacher aides participated in few career development courses due to the lack of incentive offered by the local district's classified pay scale.

(e) Instructional methods and materials developed by the Resource Teachers during the year were comprehension questions for classroom use, organization of learning center ideas, a skills checklist developed for the language arts program, class counseling procedures, and development of materials for learning centers. In contrast, similar materials and new teaching techniques were available to non-Follow Through classroom teachers only through their own individual efforts. No Resource Teachers were employed by the district to collect and disseminate new methods and materials to non-Follow Through teachers.

(f) Follow Through Resource Teachers attended six instructional conferences and/or workshops. These covered a wide range of topics including Reading, Learning Centers, and curriculum development. The information gained in these stssions was then presented to Follow Through teachers and aides in workshop or demonstration sessions.

(f) Follow Through parents volunteered for a total of 3765 hours in the Follow Through classrooms of 5 elementary schools. In contrast, only 1727 volunteer hours were spend in the non-Follow Through classrooms of 15 schools (over 600 of these hours were coordinated by Head Start).

Parent and Community Involvement

(a) Follow Through parents received 650 home visits from social services personnel and 1,212 visits from para-professional instructors. Over 200 visits from a Follow Through nurse and nurse's aide were made. No comparable services were available to non-Follow Through parents.

(b) Four hundred and forty-nine (449) Follow Through parents in five schools containing Follow Through classrooms served as classroom, workshop, and social/health volunteers for a total of 9,157 hours. Over 130 retired and interested community people volunteered in the program. In contrast, the non-Follow Through volunteer hours totaled 3,900 divided among classrooms in 16 elementary schools.

(c) A Follow Through Policy Advisory Committee (PAC) held eight monthly meetings with a total of 414 participant hours. Committee members had input into major policy decisions such as budget preparation, year-end reports, and hiring of personnel. Each school has a non-Follow Through PAC adapted from the Follow Through model. While these non-Follow Through PAC's provide for parent input into school issues, they are not involved in hiring or budget decisions.

(d) Follow Through parents participated in both educational and social workshops. Some of the workshops held involved mathematics, sewing, health, nutrition, and handicraft instruction. One Information and one Back to School Night was conducted in each Follow Through school. A spring luncheon was given for 109 parents in appreciation of their many hours of volunteer time. One PAC member went to a fall conference at the University of Georgia for training. In comparison, there were no non-Follow Through educational workshops and no regularly scheduled school nights (the PTA did sponsor some).

(e) Follow Through Resource Teachers were actively involved in the presentation of five public information sessions regarding Follow Through philosophy and curriculum. They were also involved in two presentations to Kindergarten parents titled "An Overview of Follow Through." Follow Through Resource Teachers researched and compiled a list of community resource persons to enrich Follow Through curriculum. This resulted in approximately 150 hours of volunteer resource time in Follow Through classrooms. No such Resource guide was available to non-Follow Through classrooms.

(f) A Pocatello Follow Through newsletter was published every two months to inform parents of local activities and issues of concern to Follow Through. A Parent Telephone Tree functioned for the same purpose.

Non-Instructional Services

(a) Follow Through children received more free or partially subsidized medical examinations and referrals than did non-Follow Through children.

General. In an effort to examine each child at least once within each 2 years, 133 Follow Through examinations were completed in 1976-77. Of these children, 12 needed follow-up at time of physical examinations, and 81 were referred for treatment or medical care. The Follow Through R. N. visited Follow Through schools and each Follow Through classroom once a week, and was able to quickly follow up problems. Parents were referred to a number of community agencies where appropriate.

The non-Follow Through children in School District #25 follow the school policy. The school policy states: "At the present time, we recommend, where conditions permit, that three "routine examinations" be given during the school life of the child: before entry into school (Kindergarten or first grade); at about grade 6 or 7 (late childhood and early adolescence); at about grade 11 (adolescence and prior to leaving school)" (taken from: A School Health Manual for Idaho, Nov. 1970, page 34).

In contrast to weekly visits to individual classrooms by the Follow Through nurse, the school district relies on monthly visits to schools by Public Health Nurses from the Health Department. These nurses typically check with principals or secretaries rather than teachers. Many non-Follow Through children were not taken to doctors except when they were ill.

Immunization. During the months of September 1977 to January 1978, the elementary school children's immunization levels were surveyed by the Southeastern District Health Department. It was found that an alarming number of children in this age group were not protected. However, it was also noted that "immunization levels for children in the upper socio-economic schools were at times lower than in the schools attended by children whose parents were in the lower middle class or poorer economic brackets." Since the Follow Through R. N. and aide periodically reviewed each child's immunization record and notified parents of immunization that was needed, it is likely that these activities contributed to the findings of the Health Department, with regard to children from low-income families.

Vision Screening. All children in the Follow Through Program--grades 1 and 3 were vision-screened by the R. N. using a Keystone vision screener. Grade 2 was the only grade vision-screened by the school. The Sight Technician used the Titmus screener. Grades 4 and 6 were screened by the Public Health Nurses using the Snellen test. Therefore proportionately more children were referred from the Follow Through Program in grades 1 and 3 than from the school district. A total of 32 Follow Through children in grades 1 and 3 were referred for further eye examinations.

Health/Hygiene Instruction. The R. N. in the Follow Through Program taught or arranged to have taught units in the classrooms. Subjects covered were: bus safety and walking safely, dental hygiene, first aid, and nutrition. The R. N. taught parent groups about the "Heimlick Manover."

(a) Follow Through children received more free or partially subsidized dental examinations and referrals than did NFT. One hundred eighty-six low-income Follow Through children had dental examinations: 131 were referred for follow-up and 95 of those referred completed all dental care. Non-Follow Through children were seen by the dentist at the parents' discretion.

Follow Through classrooms were visited by the Dental Hygienist from the Health Department and taught proper brushing technique, and each child was given a tooth brush. Non-Follow Through classrooms in the same schools were invited by Follow Through to the presentations. Two non-Follow Through classrooms participated with the Follow Through classrooms. Other non-Follow Through children in the school district did not receive the above instruction from the Dental Hygienists.

Limited emergency dental care was available to NFT low-income children in School District #25 who were not under any other service. Corrective dental care was not available.

(b) Psychological services and referrals in School District #25 were about equal for Follow Through and non-Follow Through children. These services are available to all children throughout the school district. A total of 57 eligible Follow Through children received psychological services.

(c) Follow Through children received free breakfast more often than non-Follow Through children because breakfast was available in all Follow Through schools; however, it was not served in all schools in the district. Follow Through children received more free lunches than NFT children because more of them qualified for free lunches. All children throughout School District #25 were also served free lunches if they qualified. There were children eligible for free lunches who were not made eligible for Follow Through because the guidelines for free lunches allowed a family to make approximately $3,000 more than the guidelines for Follow Through eligibility.

Discussion

These results suggest that the MAP-FT program in Pocatello has been successfully implemented. The program appears to have enhanced children's rates of cognitive development and their applications of intellectual problem-solving skills to academic content areas. The gap between MAP-FT and NFT academic achievement appears to have been narrowed in some cases and stabilized in others. In addition, children and families have received medical, dental, nutritional, and social services which otherwise would not have been available to them. Parents who typically are "turned-off" by schools have been drawn into classrooms as volunteers and aides, have participated in policy-making decisions, and have been encouraged to pursue their educations and develop careers. Teachers have received instruction and consultation designed to develop the knowledge and skills required to implement the program.

Two unexpected results were found. First, although family characteristics predict low-readiness scores for FT children, both FT and NFT first graders begin school at or above the national norms. Second, between first and fourth grades, children's achievement drops relative to the national norms, although the drop is generally less for FT children than for NFT. The relatively high readiness scores might be attributable to experiences offered to children before enrollment in FT. Children may have been enrolled in a variety of preschools (Montessori, Title I, Head Start, Kindergarten). Untapped ethnographic characteristics such as parents' child-rearing philosophies may also have been influential. The yearly decline in percentile scores might be attributed to "artificial" statistical features of the different national norm groups across grade levels, test content differences, differences in test administration techniques, selective attrition of the higher achievers, implementation differences among grade levels, or damaging changes in the community or school system over time. There is insufficient evidence to examine which, if any, of these factors played a role. While FT children decline less than NFT in many cases, the relative low scores they obtained may have been exacerbated by a disproportionate enrollment of children with learning disabilities. Because FT is perceived as a compensatory program with high adult/student ratios and individualized instructional methods, children with emotional and learning disabilities may be placed in FT rather than NFT classrooms. At the same time, administrators and FT teachers may be reticent to recommend these children for special education programs. While there is some anecdotal evidence supporting this possibility, data are only currently being collected to evaluate it. Finally the observed differences between FT and NFT scores may have been increased because of a FT "spread effect". To the extent that FT is a success, low-income parents become middle-income parents with children in non-FT classrooms, parent involvement has increased in the community as a whole, and certain FT classroom and noninstructional practices have been adopted by non-FT teachers and staff. At the same time the institutionalization of FT practices in the school system as a whole may hurt an evaluation strategy which depends on a comparison of FT with non-FT practices and outcomes. Two evaluation strategies are recommended for future studies in order to counteract distortion due to learning-disabled children in FT classrooms and the possible "spread effect" of the FT program. First, children with learning disabilities should be identified and evaluated separately. Second, a non-FT comparison group should be sought in a different community with a demographic profile similar to that of Pocatello, but without a FT or similar program. While the data reported suggest a number of program effects, until a suitable comparison group is found and data are analyzed, we hesitate to make any conclusive claims regarding the program's full impact on children.

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APPENDIX 1: PARENT QUESTIONNAIRE

THE UNIVERSITY OF GEORGIA
ATHENS, GEORGIA 30602

THE MATHEMAGENIC ACTIVITIES PROGRAM
FOLLOW THROUGH
FAIN HALL
404-542-4400

We are an Equal Opportunity/
Affirmative Action Employer

Dear Parent,

University of Georgia Follow Through is studying the effects of different kinds of classroom programs on children in Pocatello. When researchers look at these effects, they need to know something about the home-life of the children. This helps in deciding whether the research results are truly due to experiences children have in classrooms rather than experiences they have at home.

The following questionnaire is being given to parents of children who were selected at random for this study. We would greatly appreciate your cooperation in filling out this form. When you have completed this questionnaire, place it in the envelope, seal it and return it to the person who gave it to you. All questionnaires will be sent directly to the University of Georgia and will be used to provide an overall picture of Pocatello families. Your family and children will remain anonymous. No names will be used and your answers will become only statistics in this study.

Thank you for your help.

Sincerely,

Paul Silverman
Evaluation Coordinator

PS:jwb

IDENTIFICATION #____________

Please read the following questions and circle one response for each question.

1. Who provides the main source of support for the family?
    - A. Father
    - B. Male guardian or male relative
    - C. Mother
    - D. Female guardian or female relative
    - E. More than one of the above
    - F. None of the above

2. What is the total number of living children in the family? Include stepchildren and those not now living at home.
    - A. One
    - B. Two
    - C. Three
    - D. Four
    - E. Five
    - F. Six
    - G. Seven
    - H. Eight
    - I. Nine
    - J. Ten
    - K. Eleven
    - L. Twelve or more

3. How many different houses or apartments (not considering vacations away from the regular home) has the family lived in, in the last three years?
    - A. One
    - B. Two
    - C. Three
    - D. Four
    - E. Five
    - F. Six or more

IDENTIFICATION # ____________

4. How many different schools has your child in this classroom attended? (include this school)
   - A. One
   - B. Two
   - C. Three
   - D. Four or more

5. Please make the best estimate possible of the family's current monthly income. Include money earned by both parents and anyone else in the household who worked.
   - A. Less than $300
   - B. $300 to $599
   - C. $600 to $899
   - D. $900 to $1,199
   - E. $1,200 or more

6. How many books are in the home? (Do not include magazines)
   - A. None, or very few (0-10)
   - B. A few books (11-25)
   - C. More than one book shelf full (more than 26)

7. Are you married, single, separated, divorced or widowed?
   - A. Married
   - B. Single
   - C. Separated
   - D. Divorced
   - E. Widowed

8. Mark the one answer indicating the highest level of education the father or male guardian reached.
   - A. None, or some grade school
   - B. Completed grade school
   - C. Some high school, but did not graduate
   - D. Graduated from high school
   - E. Vocational or business school, but did not graduate from high school
   - F. Vocational or business school after graduating from high school
   - G. Some junior or regular college, but did not graduate
   - H. Graduated from a regular 4-year college
   - I. Master's degree
   - J. Some work toward doctorate or professional degree
   - K. Completed doctorate or professional degree

9. Mark the one answer indicating the highest level of education the mother or female guardian reached.
   - A. None, or some grade school
   - B. Completed grade school
   - C. Some high school, but did not graduate
   - D. Graduated from high school
   - E. Vocational or business school, but did not graduate from high school
   - F. Vocational or business school after graduating from high school
   - G. Some junior or regular college, but did not graduate
   - H. Graduated from a regular 4-year college
   - I. Master's degree
   - J. Some work toward doctorate or professional degree
   - K. Completed doctorate or professional degree

APPENDIX 2:

CORRELATIONS BETWEEN PARENT QUESTIONNAIRE RESPONSES AND OUTCOME MEASURES (FT AND NFT, COMBINED)

GRADE 1	Number of Children	(N)	Different Houses	(N)	Different Schools	(N)	Family Income	(N)	Number of Books In Home	(N)	Father's Education	(N)	Mother's Education	(N)	Metropolitan Readiness Test	(N)
Conservation	-.09	(99)	-.12	(99)	-.01	(98)	.28	(96)	.09	(98)	.38	(92)	.28	(96)	.49	(110)
SRA Language[1]	-.17	(87)	-.00	(87)	.01	(87)	.44	(85)	.27	(87)	.44	(82)	.46	(84)	.60	(319)
SRA Reading	-.13	(87)	.01	(87)	.09	(87)	.30	(85)	.28	(87)	.33	(82)	.30	(84)	.48	(319)
SRA Mathematics	-.02	(87)	-.16	(87)	-.07	(87)	.49	(85)	.27	(87)	.34	(82)	.39	(84)	.60	(319)
GRADE 2																
Conservation	-.02	(64)	-.14	(63)	.08	(64)	.40	(62)	.51	(64)	.37	(61)	.31	(62)	-	
SRA Language[1]	-.03	(61)	-.14	(60)	-.10	(61)	.28	(59)	.32	(61)	.31	(58)	.23	(59)	-	
SRA Reading	-.08	(61)	-.17	(60)	-.08	(61)	.28	(59)	.37	(61)	.40	(58)	.25	(59)	-	
SRA Mathematics	.08	(61)	-.14	(60)	-.08	(61)	.37	(59)	.41	(61)	.34	(58)	.27	(59)	-	
GRADE 3																
Conservation	-.06	(93)	-.26	(93)	-.09	(92)	.21	(87)	.06	(92)	.19	(87)	.23	(90)	.28	(88)
SRA Language[1]	-.13	(86)	-.03	(86)	-.11	(85)	.38	(80)	.39	(85)	.42	(81)	.24	(83)	.67	(120)
SRA Reading	-.21	(86)	-.03	(86)	-.13	(85)	.41	(80)	.36	(85)	.43	(81)	.27	(83)	.69	(120)
SRA Mathematics	-.15	(86)	-.04	(86)	-.10	(85)	.30	(80)	.32	(85)	.32	(81)	.20	(83)	.65	(120)

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[1] Stanford Research Associates Achievement Test--Primary I (Grade 1), Primary II (Grades 2 and 3).

APPENDIX 3:

Pocatello Follow Through Conservation Compared to Pocatello Non-Follow Through (One-way Analysis of Variance)

	N	$\bar{X}$	S.D.	
Grade 1				
FT	67	8.85	(5.74)	$F(1,109) = 23.30$, $p<.001$
NFT	44	14.59	(6.68)	
Grade 2				
FT	39	15.64	(5.65)	$F(1,79) = 10.42$, $p<.001$
NFT	42	19.50	(4.61)	
Grade 3				
FT	42	19.05	(4.52)	$F(1,86) = 4.29$, $p<.04$
NFT	46	20.63	(2.44)	

APPENDIX 4:

One-way Analyses of Variance Applied to Fall, 1973 Grade 1 MRT Spring, 1976 Grade 3 SRA, and Spring, 1977 Grade 4 SRA Follow Through versus Non-Follow Through

	N	$\bar{X}$	S.D.	
1973 Grade 1, MRT				
FT	51	63.22	(12.35)	F(1,89) = 9.94, p=.002
NFT	40	71.03	(10.57)	
Math				
1976 Grade 3, SRA-P2				
FT	51	34.75	(10.82)	F(1,89) = 26.53, p=.000
NFT	40	45.33	(7.83)	
1977 Grade 4, SRA-Blue				
FT	51	29.16	(10.80)	F(1,89) = 25.16, p=.000
NFT	40	41.68	(12.73)	
Reading				
1976 Grade 3, SRA-P2				
FT	51	31.67	(11.23)	F(1,89) = 31.16, p=.000
NFT	40	43.23	(7.28)	
1977 Grade 4, SRA-Blue				
FT	51	36.29	(12.64)	F(1,89) = 30.52, p=.000
NFT	40	53.50	(16.74)	
Language				
1976 Grade 3, SRA-P2				
FT	51	40.98	(10.28)	F(1,89) = 46.29, p=.000
NFT	40	53.80	(6.50)	

	N	$\overline{X}$	S.D.	
1977 Grade 4, SRA-Blue				
FT	51	43.20	(12.83)	F(1,89) = 42.91, p=.000
NFT	40	63.00	(15.68)	

APPENDIX 5: COHORT 5 FOLLOW THROUGH ACHIEVEMENT COMPARED TO NON-FOLLOW THROUGH, GRADES 2 AND 3

One-way Analyses of Variance Applied to Spring, 1976 Grade 2 SRA
and Spring, 1977 Grade 3 SRA
Follow Through versus Non-Follow Through

	N	$\bar{X}$	S.D.	
Math				
1976 Grade 2, SRA-P2				
FT	75	23.65	(9.32)	F(1,131) = 32.47, p=.000
NFT	58	32.85	(8.90)	
1977 Grade 3, SRA-P2				
FT	75	36.21	(11.42)	F(1,131) = 26.18, p=.000
NFT	58	45.16	(7.55)	
Reading				
1976 Grade 2, SRA-P2				
FT	75	22.47	(10.28)	F(1,131) = 65.73, p=.000
NFT	58	36.48	(9.17)	
1977 Grade 3, SRA-P2				
FT	75	30.09	(10.44)	F(1,131) = 71.21, p=.000
NFT	58	43.60	(6.95)	
Language				
1976 Grade 2, SRA-P2				
FT	75	31.67	(10.53)	F(1,131) = 44.40, p=.000
NFT	58	43.67	(9.83)	
1977 Grade 3, SRA-P2				
FT	75	40.25	(11.52)	F(1,131) = 49.54, p=.000
NFT	58	53.05	(8.53)	

PS 011513

MAP-FT Project Evaluation Report

McCormick, South Carolina[1]

Prepared by Dennis D. Kerkman,
Paul S. Silverman and Charles D. Smock[2]

June, 1976

Mathemagenic Activities Program
University of Georgia Follow Through
Charles D. Smock, Director
Paul Silverman, Evaluation Coordinator
John R. Cryan, Program Development Coordinator
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[2] Appreciation is expressed to Miss Helen Brown, Project Director, the teachers and children of McCormick County and to the MAP staff, especially Dr. Carl Huberty for help in preparing this report.

Foreward

In 1969 the Mathemagenic Activities Program (MAP) was funded as a sponsor in the Follow Through Program (FT), a national experiment to produce educational models designed to enhance the development of young children from low-income families. With the cooperation of the communities it served, MAP-FT began its evaluation program that year. Standardized readiness and achievement tests were administered to FT and non-FT children upon entry in school and at various points during their enrollment. In 1970, "special studies" concerned with underlying theoretical issues were initiated to assess: (1) the patterns of cognitive development of children in MAP projects; and (2) the particular influence of the MAP Classroom Learning Environment on aspects of cognitive development. To date, measures of children's competencies in a variety of areas have been used in addressing issues such as: the impact of kindergarten on children's subsequent performance, the effect of factors beyond direct control of the sponsor (e.g., readiness level, income level), the performance of children after they leave the program, and the impact of the number of years of teacher experience with MAP on achievement. Many of the studies involved are still in process, while others have been completed and published as MAP Reports, Bulletins, and Newsletters. Most of the published studies have focused on research designed to describe MAP effects in general rather than MAP effects in specific communities. Much of that research, however, is of special interest to each project and we hope this report contributes useful information to all those concerned with the education of young children in your community.

C. D. Smock, Director
Mathemagenic Activities Program

Preface

The Mathemagenic Activities Program is a model for early childhood education, sponsored by the National Follow Through Program, based primarily on Piaget's theory of cognitive development. The emphasis on structure of cognitive operational systems (logico-mathematical experiences) as the basis for understanding intellectual development provides mathematics educators with a unique opportunity for potential contributions to child development. This paper explores some of the implications of Piaget's theory for mathematics learning and teaching.

C. D. Smock, Director

Abstract

This preliminary evaluation report summarizes the results of several investigations of the impact of the Mathemagenic Activities Program-Follow Through (MAP-FT) in McCormick, South Carolina. The majority of Follow Through (FT) and non-Follow Through (NFT) children in this rural community come from low income families. Program impacts on three areas of competence have been examined: academic achievement, cognitive development, and application of cognitive processes to academic content.

Academic achievement. Cohort I FT scores exceeded NFT through grade 2, followed by converging performance levels through grade 5. A comparison of Cohorts I and III revealed greater subtest scores for both Cohort III FT and NFT at grades 1 and 3. At grade 2, NFT Cohort III exceeded I, while FT Cohort I exceeded III. Examination of the effects of enrollment in Cohort I FT kindergarten (K) showed FT with K scoring higher through grade 4 than FT with no K. Results of another analysis (at Cohort III) suggested that FT K has a greater impact than NFT K. Examination of post-grade 1 FT summer school impact showed that Cohort I children with FT summer school experiences score higher in fall, grade 2, than Cohort III FT children with no summer school.

Cognitive development. Piagetian measures of development (conservation, classification) reveal strong FT effects. Cohort I FT children consistently attain higher conservation scores through grade 4. At grade 3 Cohort I FT children reach a transitional period, in the ability to classify, earlier than NFT counterparts. The impact of Cohort I K on conservation is apparent through grade 2.

Relations between cognitive development and academic achievement. Analysis of Cohort I FT and NFT conservation and achievement data in grades 1 through 4 suggests that MAP-FT accelerates the application of relational thinking to academic content areas and increases the degree of application.

Though many of the studies focus on Cohort I children, the first group to pass through the program, results are encouraging. Detailed analysis of the cognitive, socioemotional, and academic abilities of later groups should extend these findings.

Mathemagenic Activities Program-Follow Through
Project Evaluation Report: McCormick County, South Carolina

Introduction

This report is a preliminary summary of results of the Mathemagenic Activities Program-Follow Through (MAP-FT) Project in McCormick County, South Carolina. This is not intended in any sense to be a final report, but is designed to summarize results from studies both completed and ongoing where those data are available. In some cases, there is a lack of matched comparison groups (i.e., Non-Follow Through students). When this is the case, the results cannot be used to judge the comparative "success" or comparative "failure" of Follow Through in the usual way. Rather, another "standard" is used; for example, some predetermined or "expected" level based on performance of similar children. Another limitation is that much of the data reported here are derived from standardized achievement tests. MAP-FT is a process model with the primary objective of influencing the level and rate of cognitive development. The interpretation of achievement test data, therefore, needs to be qualified since achievement test scores offer only an indirect measure of the success of the program. It is hoped, of course, that FT achievement scores will not fall below those of NFT counterparts but, more importantly, that any achievement gains shown by FT children reflect gains in general cognitive and problem solving abilities.

The report is intended for a general audience who may, or may not, be familiar with educational research and evaluation. Therefore, explanatory material has been included in footnotes and parentheses where appropriate.

Community Description

McCormick County is located in the piedmont of the Appalachian Mountains, along the southwest border of South Carolina, just across the Savannah River from Georgia. One major source of economic growth in McCormick's establishment and early development was a gold mining operation. This growth trend began to reverse itself when the gold vein was depleted in the mid-nineteenth century. Now the county is economically poor and relatively isolated from outside contacts. Local industries include textile and apparel manufacture, construction, lumber, and agriculture, although much business activity is siphoned off by adjacent large trade centers. For this reason many of McCormick's 8,000 residents must commute to work outside the county. Despite the lack of local industrial development, the county had a low rate of unemployment in 1970; the overall rate was 2.6%. The unemployment rate for its 3,151 (39.6%) whites was .9%, while for its 4,800 (60.3%) blacks, the rate was 4.2%. The average family income places McCormick 41st out of the 46 counties in S.C. In 1970 the mean family income was \$5,547; \$4,243 for black families and \$6,722 for white families.[1] McCormick's school system consists of classes for the first through eleventh grades. In addition, Follow Through-funded kindergartens are provided. The schools are dispersed about the perimeter of the county. The Mathemagenic Activities Program (MAP) model of Follow Through (FT) now sponsors all but three of the twenty-seven kindergarten through third grade classes at this project site.

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[1] The Office of Economic Opportunity poverty guidelines in 1970 listed \$4,400 per year as poverty level for a non-farm family of five.

MAP-FT Classroom Description

The learning environment of McCormick MAP-FT classrooms is designed according to the following principles: (a) Mismatch, or appropriate structuring of the child's physical and social environment and learning units that are slightly above his prior conceptual level; (b) Coordinated activities in which children learn through active manipulation of their physical, social and symbolic environments; (c) Self-regulation promoted by "learning territories" which encourage instructional strategies that provide for appropriate variation in modes of learning as well as balance between highly structured and relatively low structured learning situations and between group and individual learning activities. Thus, sequentially structured sets of curriculum materials and processes are designed so that continual "challenges" to learn are provided. In addition, the interlocking nature of different curriculum contents (e.g., overlap of Science, Art and Language) creates possibilities for the coordinated development of intellectual processes and skills through a variety of media, activities and social situations. In its classroom structure MAP requires two instructional aides in order to provide a high level of social interaction in small group instructional task situations.

Entering Characteristics of McCormick MAP-FT and Non-FT Children.

The entering characteristics of a sample of McCormick children are shown in Table 1. Data were available for FT and Non-FT (NFT) children who entered first grade in Fall, 1970 (Cohort I).[3] The FT children had been enrolled in kindergarten and summer school the previous year.

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[2] See MAP Program Process Description for a more detailed discussion of the Classroom Learning Environment and teacher strategies.

[3] Cohort I refers to those children who entered the FT program in fall, 1969 as kindergarteners when the program was in its first year of operation in McCormick County. These children exited from FT in 1973, after they had been enrolled for four years. Similarly, Cohorts II, III, etc. entered kindergarten in successive years.

Table 1
Entering Characteristics of Children
First Grade, 1970-71; Cohort I

Mean			Number of Children					
				Low	Ethnic Group		Sex	
Program	Age	MRT	Total	Income	White	Black	Male	Female
FT	5.34	45.9	100	76	7	93	55	45
NFT	5.62	27.5	29	29	0	29	15	14

In first grade the majority of children were enrolled in FT classes. Most (81%) of the children in both the FT and NFT programs were from low income families.[4] FT children scored substantially higher than the NFT group on the Metropolitan Readiness Test (MRT) administered in fall, grade 1. This test estimates how well-prepared a child is for the academic material of grade 1. The higher FT scores can be attributed to the effects of kindergarten.

While many of the following analyses do focus on this group of children, the entering characteristics of past and future FT and NFT groups can be reliably inferred in this stable community.

MAP-FT Effects on Academic Achievement

The effects of MAP-FT on academic abilities of children can be examined several ways. Three quite fundamental questions are: (1) Does MAP-FT influence children's achievement scores while they are enrolled in the program (grades K to 3)? (Three-year Impact); (2) Do the effects of MAP-FT continue beyond grade 3? (Post-FT Effects); (3) Does the number of years that MAP-FT has been in the community effect the academic performance of the children? (Maturity Effects). Two particular characteristics of the McCormick MAP-FT program provide conditions for additional questions. Most FT children were enrolled in kindergarten and, from 1970 through 1972 were enrolled in summer school as well. The questions, then, are (4) Does kindergarten influence later academic performance and is the effect (if any) due specifically to MAP-FT kindergarten? (Kindergarten Impact); (5) Does MAP-FT summer school effect academic performance? (Summer School Impact).

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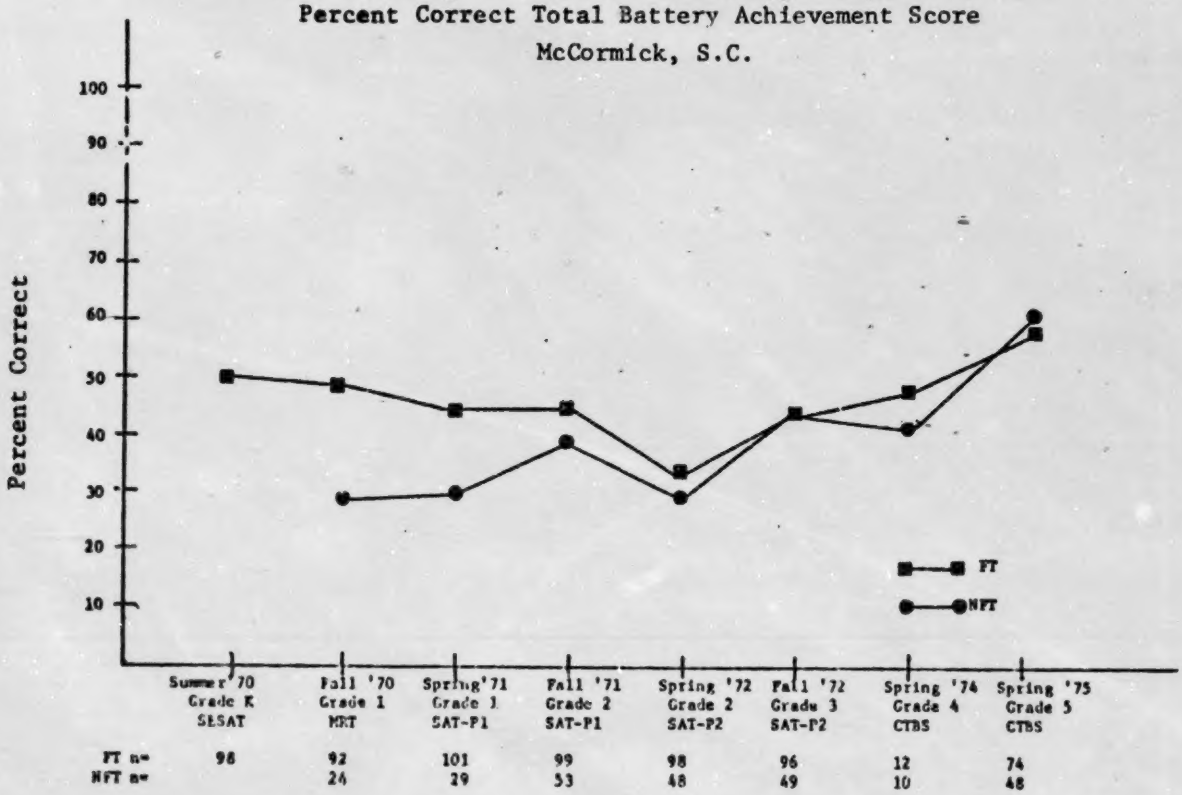
[4] For an index of "low-income", the reader may refer to Department of Health, Education and Welfare, Office of Education: Follow-Through Program, Washington, D. C. Federal Register. 1974, Vol. 39, No. 121, Part II.

1. Three-year Impact.

FT children who entered in kindergarten, 1969, (Cohort I) were compared with NFT counterparts who began grade 1 in fall, 1970 concurrent with the entry of the FT group into grade 1. Both groups were subsequently tested through grade 5. Because of attrition, the original sample of children was supplemented with children having similar program experiences but who had not been tested on previous occasions. Figure 1 shows the percent of total achievement items answered correctly by FT and NFT children.

Figure 1
Follow Through and Non-Follow Through Compared on
Percent Correct Total Battery Achievement Score
McCormick, S.C.



The tests administered to these groups were the Stanford Early School Achievement Test (SESAT), grade K; Metropolitan Readiness Test (MRT), grade 1; Stanford Achievement Test (SAT-P1 and P-2), grades 1, 2, 3; California Test of Basic Skills (CTBS), grades 4 and 5. The relatively high FT scores in kindergarten continued through fall and spring of grade 2 with the difference decreasing through the fall of grade 3 to grade 5. Separate graphic analyses of Arithmetic Computation and Word Meaning subtests (not shown) reflect the overall trend.

2. Post-FT Effects.

The long-term impact of MAP-FT is the ultimate test of program success or failure. A re-examination of Figure 1 shows that at the end of grade 4 the scores of the FT children were somewhat higher than those of the NFT group. Caution must be exercised in any interpretations, since the sample sizes at this point are quite small. By the end of grade 5, the two groups were still performing at similar levels, with the NFT percent slightly higher.

3. Maturity Effects.

Is the length of time that MAP-FT has been in the community related to increases in children's performances? And are the increases, if any, due to MAP-FT efforts rather than to increased teacher experience independent of the program? To answer these questions, Cohort I FT and NFT children were compared to Cohort III children at grades 1, 2, and 3. FT first (1970-71), second (1971-72) and third (1972-73) grades were each in their second year of operation when Cohort I children were enrolled. FT children in Cohort III experienced each grade level in its fourth year of operation (grade 1, 1972-73; grade 2, 1973-74; grade 3, 1974-75). All of the scores used were from children from low-income families. In the analyses to follow, neither teachers' experience in MAP-FT nor childrens' readiness levels were considered due to missing data.

Maturity at grade one. A one-way multivariate analysis of variance was applied to the spring Stanford Achievement Test (SAT-P1) scores of FT children in Cohorts I and III.[5] To supplement interpretation, Cohort I and III NFT SAT-P1 scores were used in an identical analysis. Table 2 shows the mean scores on each subtest for the groups compared. The analyses indicated that with exception of spelling (where no significant difference occurred), Cohort III FT children scored significantly higher than Cohort I FT.[6] The NFT Cohort III group scored significantly higher than NFT Cohort I on all subtests.

Table 2

Comparison of Mean Raw Scores for Cohort I and III in Grade 1 on SAT-P1 Subtests

	Follow Through	(n=269)	Non-Follow Through	(n=7
Subtest	Cohort I(138)	Cohort III(131)	Cohort I (35)	Cohort III(4
Word Reading	12.49	14.57	8.91	15.55
Paragraph Meaning	12.80	15.40	5.57	16.48
Vocabulary	14.36	15.84	12.34	15.80
Spelling	7.62	8.47	4.09	8.70
Word Study Skills	25.85	29.75	21.60	29.98
Arithmetic	26.46	32.04	16.03	31.05

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[5] A one-way multivariate analysis of variance is a statistical technique for comparing several groups (e.g., Cohort I, III) on several measures (e.g., achievement subtests).

[6] Differences between means (averages) are judged to be "statistically significant" when those differences can be expected to occur by chance only 5 times out of 100, symbolized as $p < .05$.

Maturity at grade two. Two analyses of the same form were conducted on the spring SAT-P2 scores of FT and NFT second graders in Cohorts I and III. Table 3 shows the mean scores. On three subtests, Word Meaning, Spelling, and

Table 3

Comparison of Mean Raw Scores of Cohort I and III
in Grade 2 on SAT-P2 Subtests

	Follow Through (n=247)		Non-Follow Through (n=75)	
Subtest	Cohort I(134)	Cohort III(113)	Cohort I(52)	Cohort III(23)
Word Meaning	10.17	8.24	10.81	13.35
Paragraph Meaning	15.18	14.21	18.33	18.44
Science and Social Studies Concepts	12.93	13.09	13.39	14.26
Spelling	6.76	5.34	5.65	8.78
Word Study Skills	20.67	19.61	21.14	24.13
Language	27.38	26.30	27.48	27.04
Arithmetic Computation	15.19	13.35	12.79	14.96
Arithmetic Concepts	13.22	10.35	10.77	13.91

Arithmetic Concepts, FT Cohort III scores were lower than FT Cohort I. On all other subtests there were no significant differences between the two FT cohorts. For the NFT group, the same three subtests showed Cohort III exceeding Cohort I, with no significant differences between cohorts on other subtests.

Maturity at grade three. Two one-way multivariate analyses of variance were again performed on spring grade three SAT subtest scores from Cohorts I and III. Average performance levels of the four groups are shown in Table 4. Since children in Cohort III received the SAT-P3, while those in Cohort I got the SAT-P2, all raw scores were converted to national norm-referenced standard scores in order

Table 4

Comparison of Mean Raw Scores of Cohort I and III in Grade 3
on SAT-P3 and P2 Subtests, Mean Standardized Scores

Subtest	Follow Through (n=238)		Non-Follow Through (n=74)	
	Cohort I(128)	Cohort III(110)	Cohort I(57)	Cohort III(17)
Word Meaning	-1.42	-1.31	-1.23	-1.22
Paragraph Meaning	-1.52	-1.37	-1.45	- .71
Spelling	- .96	- .96	- .71	- .06
Word Study Skills	-1.30	-1.31	-1.10	- .63
Language	-1.33	-1.11	-1.08	- .33
Arithmetic Computation	-1.14	- .65	- .53	- .34
Arithmetic Concepts	- .83	- .94	- .92	- .72

to make comparisons.[7] For the FT group, Cohort III scores were significantly higher than Cohort I scores on the Language and Arithmetic Computation subtests. There were no differences between cohorts on other subtests. NFT Cohort III exceeded NFT Cohort I on the Paragraph Meaning, Spelling, Language, and Arithmetic Computation subtests, with no differences occurring on other subtests.

It is difficult to characterize maturity using only two cohorts and without taking children's entry abilities or teachers' experience into account. These data were not available, however. With this caution, the findings can be summarized. With the exception of grade 2, many FT subtests scores improved as grade levels were associated with the program for increased periods. This conclusion is generally supported by a separate study of four communities (Huberty, Lin, and Smock, 1976) which did control for both teachers' experience and childrens' readiness levels. The portion of that study which dealt specifically with McCormick (grade 1, Cohorts I, II, and III) concluded that Cohort II yielded the highest scores (especially in Word Study Skills and Paragraph Meanings), with little or no differences between Cohorts I and III. The study, however, examined this change using only one teacher.

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[7] A nationally "standardized" score is determined by transforming a raw score to one which represents the individual's standing relative to the average of a national sample. A standardized score of "0" indicates a raw score coincident with the national average. Scores above and below "0" reflect standings above and below the national average.

A NFT maturity trend similar to the FT trend at grades 1 and 3 in the present study suggests that the score increases in both programs may have been due to a single cause. Among possible influences are increased teacher experience independent of FT or spill-over of FT implementation. The latter is particularly plausible in light of the relatively large number of FT classrooms in the community.

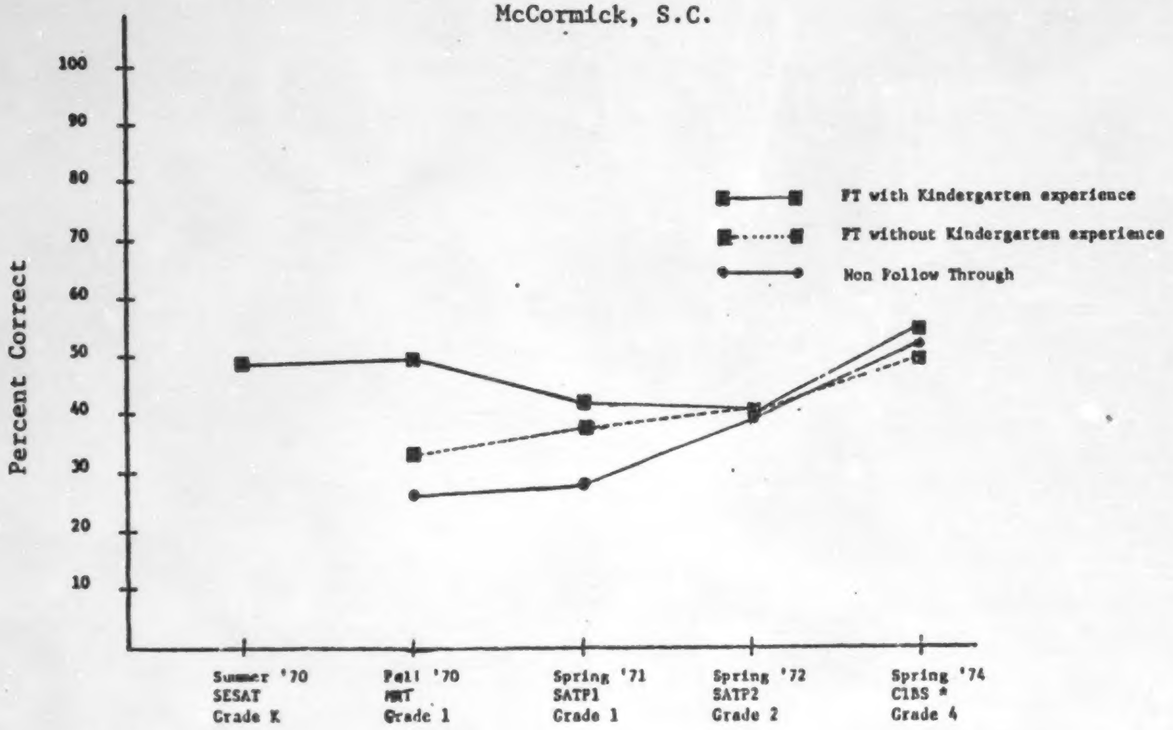
4. Kindergarten Impact.

General Kindergarten Effects. The effect of the 1969-70 MAP-FT kindergarten experience on achievement test performance is shown in Figure 2, where Cohort I FT children who were enrolled in kindergarten are compared with FT and NFT Cohort I children with no kindergarten experience. Since no NFT children were enrolled in kindergarten that year, this group is not compared with the others.

The FT children with kindergarten experience began grade 1 (fall, 1970) with higher achievement scores than either MAP-FT or NFT students who had no such prior experience ($t(125) = 2.65$, $p < .01$). By the end of grade 2 (spring, 1972 however, all groups converge while the three groups' total scores show no substantial differences in the fourth grade. Subtotal scores (not depicted here) on the Comprehensive Test of Basic Skills (CTBS) at fourth grade do reveal that FT children with kindergarten experience scored significantly higher in Mathematics Total than FT without kindergarten ($t(92) = 1.70$, $p < .05$). NFT scores were not significantly different from either of the FT groups at this point. No statistically significant group differences were found in Reading Total, the subtotal computed from the CTBS.

Figure 2
MAP-Follow Through Children With and
Without K Experience Compared to Non-Follow Through On
Percent Correct Total Battery Achievement

McCormick, S.C.



FT with K	n=96	n=90	n=89	n=86	n=85
FT without K	n=0	n=37	n=35	n=34	n=23
Non Follow Through	n=0	n=24	n=29	n=44	n=33

* Represents Reading Total and Math Total Scores only

MAP-FT kindergarten compared with NFT kindergarten. In light of the kindergarten achievement effects described above, a study was designed to determine whether the effects were specific to a MAP-FT sponsored kindergarten rather than to any kindergarten. The fall MRT scores of 113 FT and 17 NFT Cohort III kindergarteners (entered in 1971) were compared by multivariate analysis with only the univariate results considered here. An identical analysis was applied to the spring MRT scores of these kindergarteners. Only the scores of children from low-income families were considered.

In the fall of kindergarten FT children had scores lower than NFT on Listening (FT 8.1, NFT 10.1) (F(1,128) = 9.51, p < .003), Numbers (FT 5.8, NFT 8.6) (F(1,128) = 11.78, p < .001) and Copying (FT 1.2, NFT 3.7) (F(1,128) = 22.09, p < .001).

A significant difference favoring NFT was also found on Total Scores (FT 29.6, NFT 38.1) (F(1,128) = 13.30, p< .001). The two groups did not differ on the other three subtests of the MRT. In the spring of kindergarten the FT group had higher scores than NFT on Copying (FT 6.0, NFT 3.6) (F(1,128) = 7.69, p< .006) and Alphabet (FT 14.2, NFT 11.7) (F(1,128) = 8.59, p< .004). No differences were found on the remaining subtests.

In sum, when FT with kindergarten was compared to FT without kindergarten, at fall, grade 1, kindergarten experience made a difference in total readiness scores. At grade 4, a difference in mathematics achievement could be attributed to the differential kindergarten experience. By spring of kindergarten, the FT scores exceeded NFT scores in Copying, though FT scores had been lower in the preceding fall. In Alphabet, FT spring scores surpassed NFT, though they had been equal in the fall. In two other areas, Listening and Numbers, FT scores reached the level of NFT scores though they had been lower the previous fall. Thus, MAP-FT kindergartens had a positive impact on children's academic readiness and achievement. Moreover, this effect appears to be specific to MAP-FT kindergartens; i.e., over and above those effects on children beginning school in a NFT kindergarten.

5. Summer School Impact.

Children were enrolled in the MAP-FT summer school in 1970, 1971, and 1972. A study was designed to test the effects of this experience on the subsequent fall achievement scores. Two groups of FT children from whom data were available were identified. Many Cohort I children attended summer school after kindergarten (1970) and after first grade (1971). Cohort III children had attended summer school only after kindergarten (1972). In the fall of grade 2, a comparison was made between 59 Cohort I children who had experienced two successive summer schools, and 68 Cohort III second graders who had experienced one summer school. Such a comparison provided a test of the hypothesis that the additional summer school experience would facilitate the academic performance of the Cohort I children.

In light of the first grade maturity effects described earlier, the design is flawed. Recall that the overall performance of Cohort III children greatly exceeded the performance of the Cohort I group. In order to demonstrate a summer school impact, then, the counteracting influence of project maturity would have to be overcome by summer school experience.

A multivariate analysis of covariance, using fall grade 1 achievement totals as covariate, was applied to the two cohorts' fall, grade 2 SAT-P1 achievement scores.[8] Only children from low income families were included in the analysis and all had summer school after kindergarten. There was a significant difference, favoring the group with additional summer school experience, on Paragraph Meaning (14.3 vs 10.2); Word Reading (15.1 vs 12.8); Arithmetic (35.1 vs 26.9); Word Study Skills (31.2 vs 27.5); and Spelling (10.0 vs 6.6) subtests.[9] There was no difference between the two groups on the Vocabulary subtest. The additional summer school experience of the Cohort I group appears to have counteracted the effect of the lower level of program maturity to raise achievement scores above the level of the Cohort III comparison group.

MAP-FT Effects of Cognitive Development

A major goal of MAP-FT is to facilitate the intellectual development of children enrolled in the program. To the extent that traditional academic achievement reflects this development, the results of achievement testing are relevant. However, a more direct measure of program impact has been obtained through the use of Piagetian-based tests of cognitive development.

Previous research has shown that children between the ages of 6 and 8 develop certain abstract thought processes. Specifically, they begin to think about and coordinate relations among objects. For example, they understand that when water in a glass is poured into a tall cylinder the amount remains the same, though the cylinder may look as if it contains more. To reach such a conclusion, the child must reason that because the water in the glass can be poured back, because no water has been added or removed, and because the water in the cylinder is higher but smaller in diameter, something (namely the amount), has not changed. The child mentally "coordinates" pouring in one direction with pouring in the other. He also "coordinates" the two changes in appearance of the water (height and diameter). This ability to identify unchanging properties (e.g., amount of water, length of a stick, number of blocks, etc.) in spite of misleading changes in appearance is called "conservation."

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[8] Analysis of covariance is a technique which allows for statistical control of group differences (e.g., post-kindergarten summer school) which existed prior to treatment (e.g., post-grade 1 summer school). When this technique is ideally applied, any obtained differences between FT and NFT scores cannot be attributed to pre-existing academic differences.

[9] Means in parenthesis are adjusted for fall grade 1 achievement levels.

Another example of the ability to coordinate relations is the mastery of "classification." For example, in one experiment a child is shown red and blue wooden blocks that are also short and tall. The examiner makes a group of red blocks and another of the blue blocks. He then asks the child "can you make two new groups?" The child who understands that the same blocks can be re-grouped by height demonstrates an ability to coordinate dividing the blocks by height with dividing them by color. As conservation, the ability to classify develops naturally between the ages of 6 and 8.[10]

To examine the impact of MAP-FT on this thinking and reasoning aspect of intellectual development, selected comparisons from three studies (deLacey & Smock, 1974; Silverman, Epting & Smock, unpublished; Silverman & Smock, 1974) were used to re-examine the issues discussed earlier with respect to achievement; i.e., three year and post-FT effects and Kindergarten impact.

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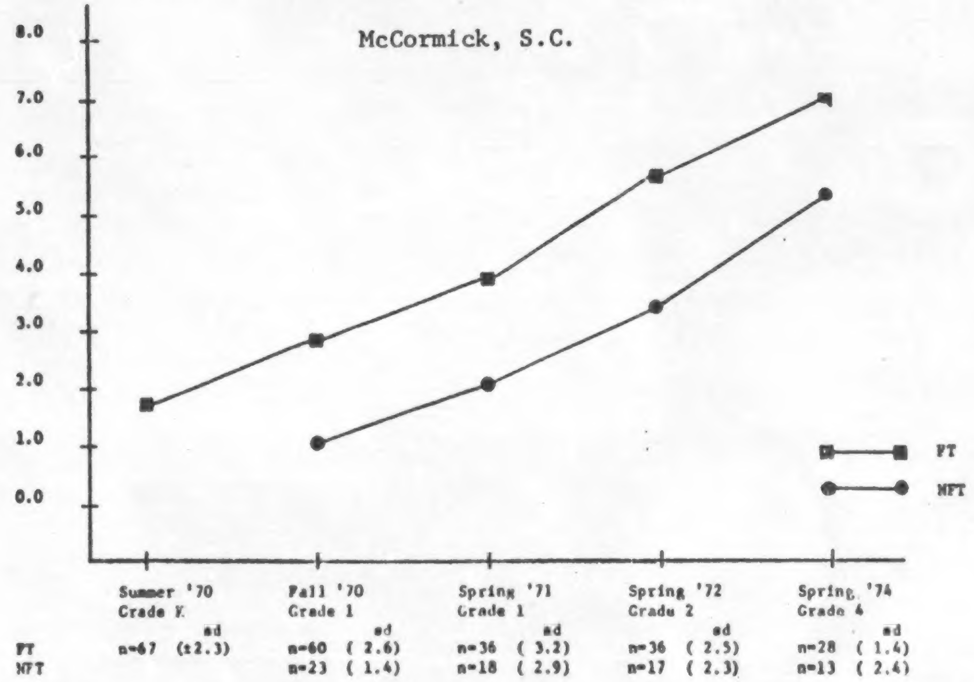
[10] Another ability not described here, but requiring the same abstract reasoning processes, is the ability to seriate objects.

1. Three-year and post-FT effects.

A test of conservation, The Concept Assessment Kit - Conservation (Goldschmid & Bentler, 1968), was originally administered to 67 Cohort I FT children in kindergarten, 1970. At four subsequent time points (through grade 4, 1974) remaining FT children were repeatedly tested along with a NFT group initially numbering 23 (Silverman, et al; Silverman & Smock, 1974). The test consists of 8 subtests, each assessing the child's ability to identify an unchanging quantity in the face of perceptual changes: (1) two-dimensional space, (2) number, (3) substance, (4) continuous (liquid) quantity, (5) weight, (6) discontinuous (solid, countable) quantity, (7) area, and (8) length. Figure 3 shows that, through grade 4, the FT average total scores were consistently higher than those of their NFT peers. No data for the NFT group are given at the first point since these children were not in the kindergarten program.

MAP-Follow Through and Non-Follow Through Children Compared On
Mean Total Goldschmid-Bentler Conservation Scores



Classification tasks were given to another group of children (grades 1 through 5) in McCormick County, S. C., Pickens County, Ga., and Gulfport, Miss. in winter, 1972-73 (deLacey and Smock, 1974). While 73% of the FT group were from low-income families, only 34% of the NFT group were low-income. The tasks included (1) the Nixon Test of Reclassification, which requires the child to successively sort and re-sort wooden pegs by height, width, or color; (2) the Inhelder and Piaget Matrices Test, which requires the child to simultaneously classify objects using several dimensions (e.g., height, orientation, and shape). An analysis of the Nixon Test at third grade (45 cohort I FT, 31 NFT) suggests that the FT children were in transit to a more advanced level of thinking than were the NFT children (Silverman & Smock, 1974). Table 5 displays this difference.

Table 5

FT and NFT Experience Compared on Classification Ability: Nixon Test

	FT		NFT				
Response Type	Mean	sd	Mean	sd	df	t	p - value
Correct operational	4.59	2.44	4.51	1.90	75	.136	>.05
Correct figurative	1.30	1.98	0.516	.811	75	2.101	.05
Incorrect	0.544	1.05	0.677	1.19	75	-0.520	>.05

The "correct operational" response type includes any response which is both correct and for which the child can offer a correct explanation. At this level of thinking the FT group scored as high as NFT. The "correct figurative" responses are typical of "transitional" children who can group the objects according to classes with a fairly high degree of accuracy, but cannot yet label the class or consistently group all the objects in the class. At this level, the FT group scored significantly higher than NFT.

On the Inhelder and Piaget Matrices Test, analysis of the same children's scores suggests that FT "operational" response scores were slightly higher than NFT (FT 4.46, NFT 3.94) though the difference was not statistically significant ($t = .896$, $df = 75$, $p > .20$).

2. Kindergarten impact.

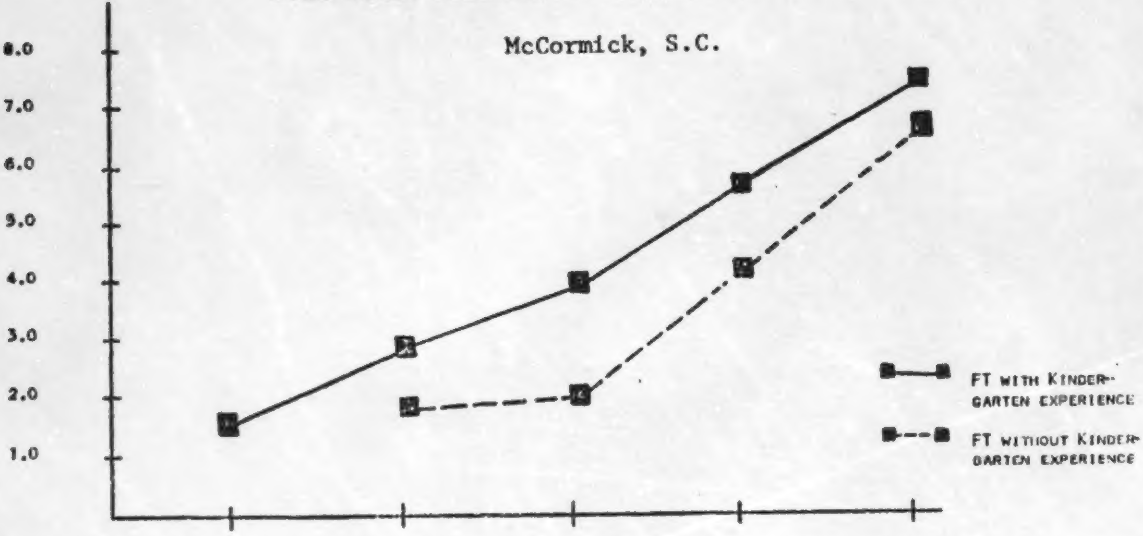
Cohort I FT children who were enrolled in kindergarten in 1970 were compared with those who had no kindergarten experience. Subtests of the conservation test described earlier were used to examine the impact of kindergarten on intellectual development.

Figure 4 clearly shows that MAP-FT children tested the summer after kindergarten experience (summer, 1970) show no higher conservation scores than the "no-kindergarten" group who were tested shortly after they entered school in grade 1 (fall, 1970). However, by first grade, scores of the children with kindergarten experience increased and were higher than the "no-kindergarten" groups ($t = 4.22$, $df = 87$, $p < .05$). This difference is still considerable at the end of second grade ($t = 1.77$, $df = 46$, $p < .01$). At the end of grade 4, the majority of children in both groups have developed the ability to conserve, and this test ceases to distinguish them. Presumably a test assessing a still higher level of cognitive development would continue to show the impact of kindergarten.

Relation Between Cognitive Development and Academic Achievement

Acceleration of cognitive development in the early primary grades should facilitate future intellectual and academic development. The relational thought processes mastered by children are not limited to the concepts of conservation and classification as they are exemplified earlier. To really understand mathematics (e.g., that 5 can be "classified" as 2 + 3 or as 1 + 4) and measurement (e.g., that one foot on a ruler is the same as one foot on a yardstick) children

Figure 4
MAP-FT Follow Through children with and without K Experience Compared On Mean Total Goldschmid-Bentler Conservation Score



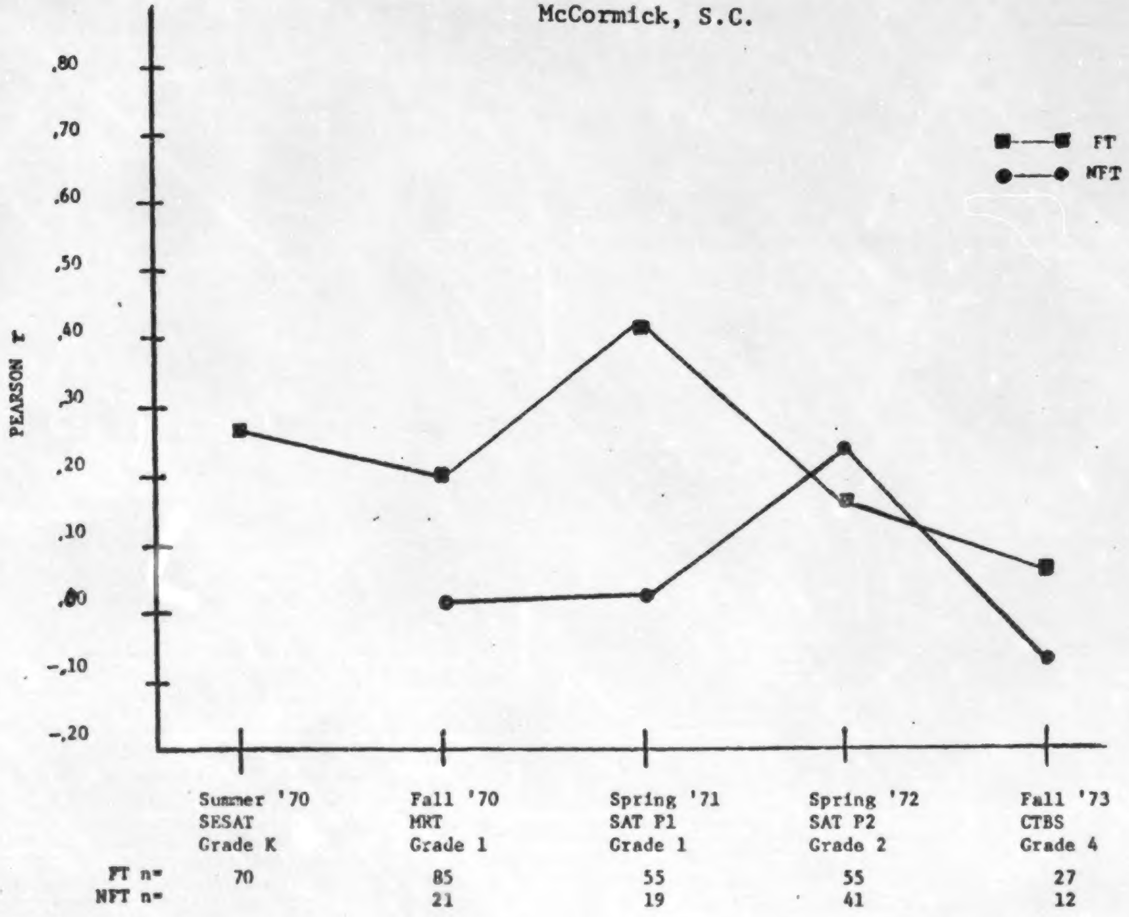
	SUMMER '70 GRADE K s.d.	FALL '70 GRADE 1 s.d.	SPRING '71 GRADE 1 s.d.	SPRING '72 GRADE 2 s.d.	SPRING '74 GRADE 4 s.d.
FT WITH K	N=67 (2.3)	N=60 (2.6)	N=36 (3.2)	N=36 (2.5)	N=28 (1.4)
FT WITHOUT K		N=29 (1.9)	N=13 (3.0)	N=12 (2.7)	N=8 (1.7)

must be able to coordinate relations. In reading, the process of skipping back and forth, relating one idea to another and guessing what is to come, requires this same abstract ability. Building a go-cart, making change, understanding historical sequences also demand this level of abstract thought. The list is endless. While it is possible for children to memorize mathematical tables and other facts and figures, research has shown that a true understanding of these areas is predicated on relational thinking.

To assess whether children in the MAP-FT program apply their cognitive gains to academic areas to a greater extent than their NFT counterparts, Cohort I children who had received both conservation and achievement tests in kindergarten through grade 4 were examined. Figure 5 shows the mean correlations between conservation and achievement scores for MAP-FT and NFT children.[11] A similar trend occurs in both the FT and NFT curves, with each mean correlation reaching a single peak (indicating a strong relationship) and then decreasing. This increase followed by a decline suggests that as the ability to conserve develops, it is reflected in academic achievement. As the children master conservation, the relationship with achievement decreases since more advanced

Figure 5
Mean Correlation Between Goldschmid-Bentler Conservation Subtests and Achievement Subtests

McCormick, S.C.



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[11] "Correlation" is a statistical technique for estimating the degree of relationship between two measures. A positive correlation (+) indicates that increases in one measure are associated with increases in the other. A negative correlation (-) indicates that increases in one measure are associated with decreases in the other. A perfect correlation would be +1.00 (or -1.00). In Figure 5, correlations among all subtests were averaged using a geometric mean.

cognitive abilities are applied to academic areas. The FT group reaches a peak earlier than the NFT group. Moreover, the FT achievement-conservation relationship is stronger. It appears, then, that MAP-FT may both accelerate and increase the degree of application of relational thinking processes to academic content areas.

Conclusion

The results of these studies are quite encouraging, even though small numbers of children were employed and many were enrolled in an early Cohort (I).

The positive effects of FT experience on cognitive development and on the application of higher level cognitive abilities (i.e., reasoning) to traditional academic content areas are clear. The FT kindergarten and summer school experiences were effective in producing gains on total achievement scores. These early achievement differences favoring Cohort I FT (vs NFT) disappeared by grade 3. However, comparisons of FT Cohorts I and III show that at both grades 1 and 3 Cohort III performance was relatively greater. A similar improvement occurred in NFT groups.

The limited absolute effect of the program on achievement scores must be interpreted in light of the MAP program goals - to facilitate development of thinking processes and problem-solving skills. Cognitive ability test results were especially encouraging in this study. Though achievement test scores reflect only minimum program impact, the relatively strong relation found between reasoning abilities and academic performance is influenced in a way not directly expressed by standardized test score changes. For example, achievement test items, when analyzed, clearly provide a variety of ways for achieving the correct answer. Two of the most obvious strategies are: (1) reiteration of facts which have been memorized, and (2) logical assessment and solution of problems. The MAP-FT classroom learning environment emphasized the latter since reasoning processes can be applied to any problem area. These preliminary results suggest that MAP-FT children do indeed apply logical thinking abilities to many areas of knowledge. Further studies of other groups of children are underway and we believe these findings and interpretations will be further strengthened.

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